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THE SUBARACHNOID SPACES OF THE ROOT SHEATHS IN THE LUMBAR REGION[1]

by

K. Lindblom

In a histologic study of the lumbar nerve roots, REXED in 1947 stated both that the normal subarachnoid tissue and spaces following the roots towards the spinal ganglia ended in tips projecting in distal direction and that adjacent to these tips the arachnoid tissue might form proliferations with cysts covered by a thinned nervous tissue. The histologic examinations did not show whether or not the cysts communicated with the normal subarachnoid spaces.

In a paper read before the Swedish Society of Radiology in September 1948 ARNELL demonstrated the widened endings of the root sheaths sometimes found at myelography and suggested that these widenings might correspond to the subarachnoid cysts described by REXED. However, the correspondence between the Rexed cysts and the dilated ends of the root sheaths seemed to be questionable, the bulges of the root sheaths in the myelograms were rather large and extrinsic whereas the Rexed cysts were small and intrinsic. This diasagreement made the author perform a roentgenographic study of the anatomical details of the lumbar root sheaths.

Material

The gross anatomy was studied on 35 specimens of the dural sac with the adjacent roots and ganglia. For detailed studies 4 other specimens were used, in which the dural sac was filled and properly distended with a barium suspension with gelatine added. In addition, the myelograms of 150 cases were reviewed; the myelographies were made with 20 percent a rodil.

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From the Roentgen Diagnostic Department of Karolinska sjukhuset, Stockholm, Sweden (Chief: Professor ÅKE ÅKERLUND).

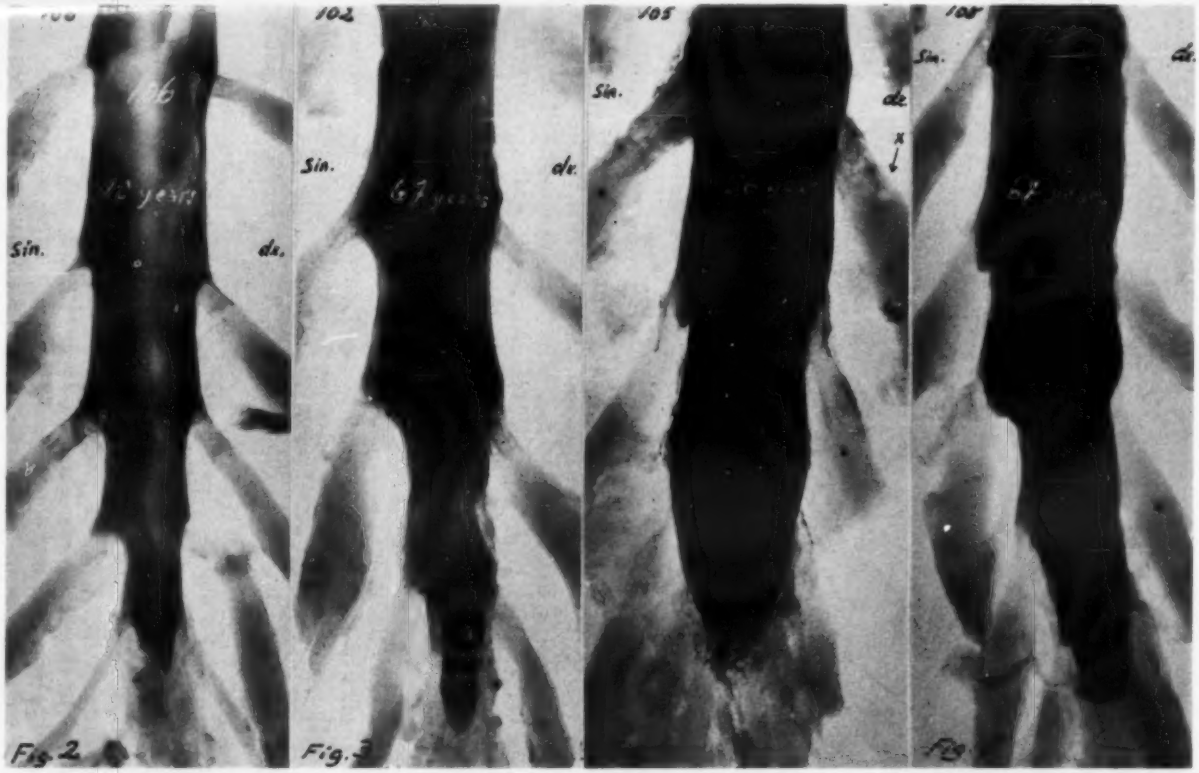
Results

By dissection of the 35 anatomic specimens it was observed that most nerve roots in the lumbar region were accompanied by the subarachnoid space of varying length. The opening of the space might be covered by parts of the arachnoid membrane. Often the space was divided by septa of mainly longitudinal direction (Fig. 1). In many cases the space projected between the roots or root bundles. As was pointed out by REXED

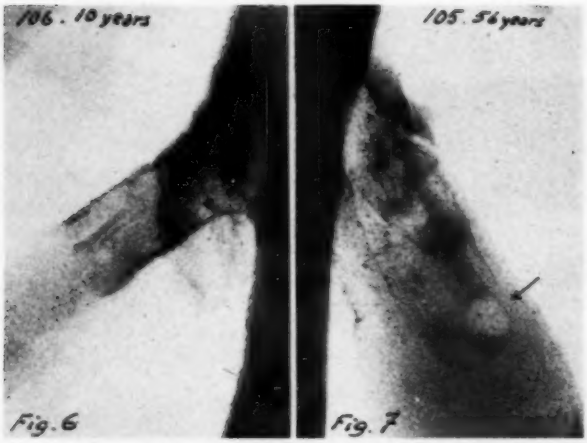
Fig. 1. Photograph of a fifth lumbar root after incision of the dural sheath. Note the septa dividing the subarachnoid space of the root sheath.

the subarachnoid space ended in tips of different length. As a rule the space was narrow.

The four specimens injected with barium suspension were roentgenographed (Figs. 2—5 and 6—7); thereafter the roots in the dural sheaths and the adjacent ganglia were cross sectioned into slices 1 mm thick. The series of slices were roentgenographed through a beryllium window at 13 kV peak (Figs. 8—10 and 11—12). The roentgenograms and the comparative inspection of the slices showed that the subarachnoid spaces within the dural root sheaths were filled with barium and might project as far as to the ganglia. They ended in fimbriae like tips and projected in between the roots and root bundles and were interrupted by incomplete septa. In one case (age 56) small cysts were found in the distal portions of three lumbar roots. The cysts were filled with a clear and colorless fluid. In one root the cyst lay partially surrounded by the barium (Figs. 4, 7 and 11). In this case as well as in another of the four cases (age 67) there were wide fissures filled with clear and colorless fluid around the roots and root bundles distal to the barium (Figs. 11—12); in addition, one root of the latter case showed a cyst near to the ganglion. These spaces and cysts did not communicate with the main subarachnoid space. In the



Figs. 2—5. Roentgenographs of four specimens in which the subarachnoid spaces were filled with barium. Note the differences in extension and shape of the root sheaths. The positions of REXED cysts are marked vith X.



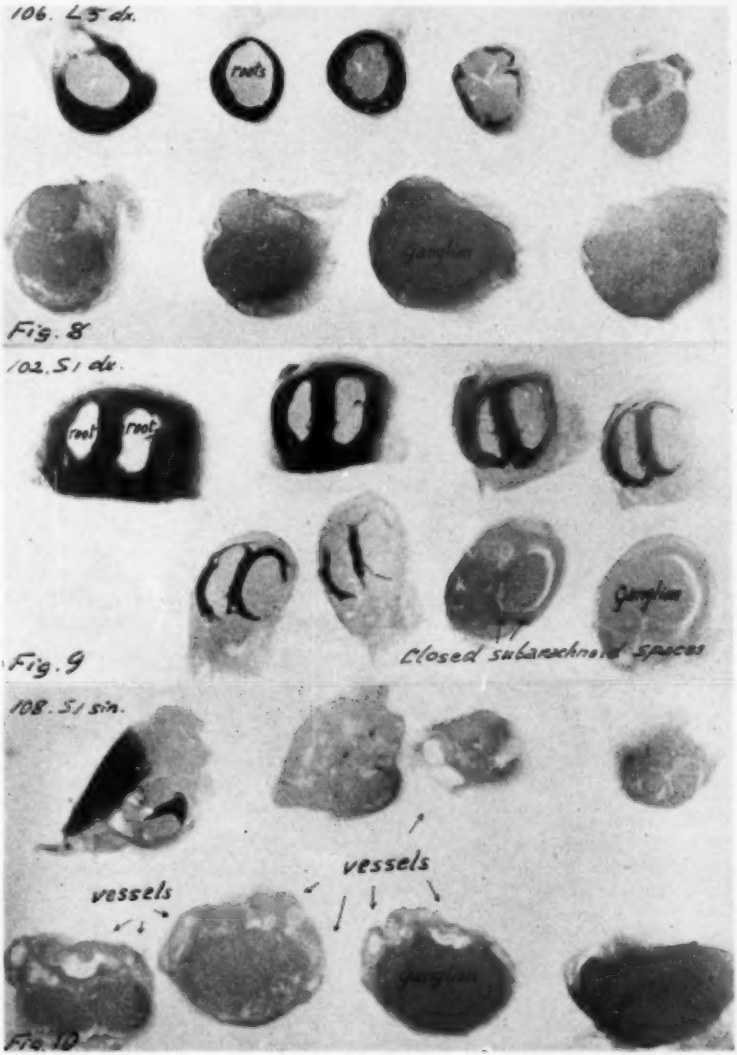
Figs. 6—7. Enlarged roentgenographs of two roots of the specimens in Figs. 2 and 4. Note the irregularity of the communicating subarachnoid spaces. The arrow in Fig. 7 marks a Rexed cyst surrounded by barium.

remaining two cases (age 10 and 67 respectively) no cysts were found and the spaces distal to the barium were few and narrow (Figs. 8—9).

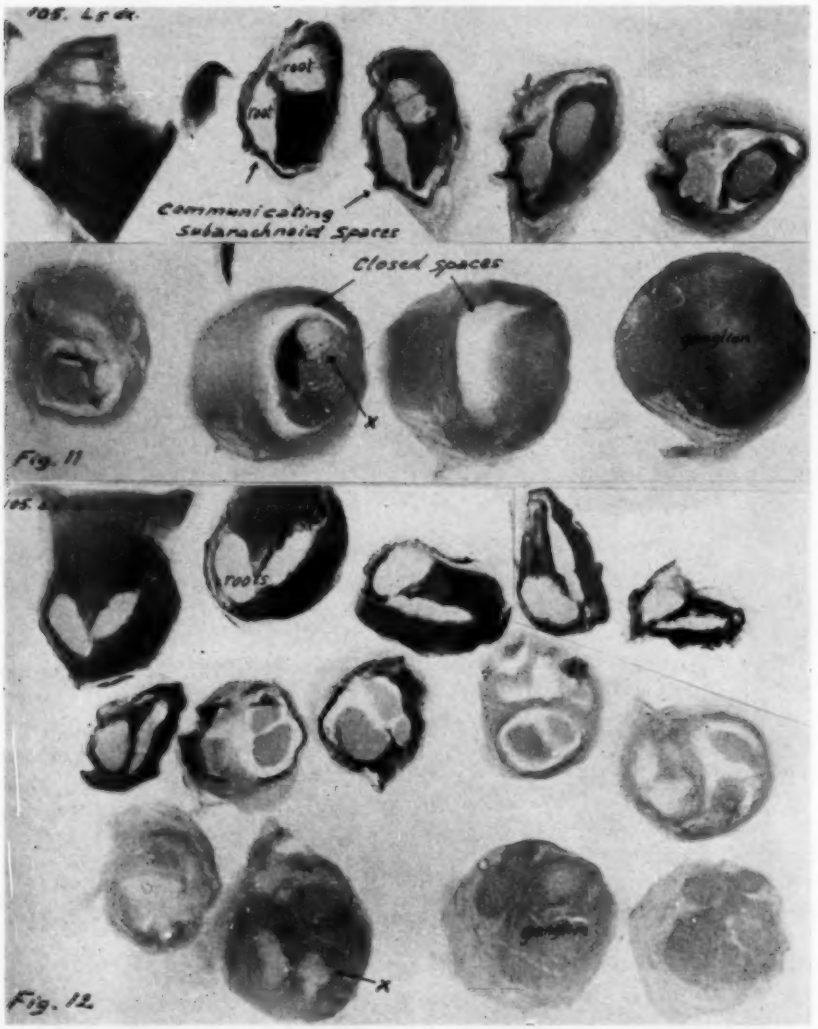
The study of the myelograms in 150 cases revealed that it was possible to see some of the details of the subarachnoid space in the dural root sheaths, such as tips at the distal end of the space, intervening spaces between roots or root bundless, and interrupted outlines of the space explainable by incomplete septa. No cavities were seen which might correspond to the Rexed cysts. In a few cases the sheaths widened in the same way as was described by ARNELL but their shape, size and position were quite different from those of the cysts.

The results of this roentgenographic and anatomic study agree with those of the histologic investigation by Rexed. It can now be added that there are no signs of communication between the subarachnoid cysts of Rexed and the main subarachnoid space. Thus the cysts cannot be seen by myelography.

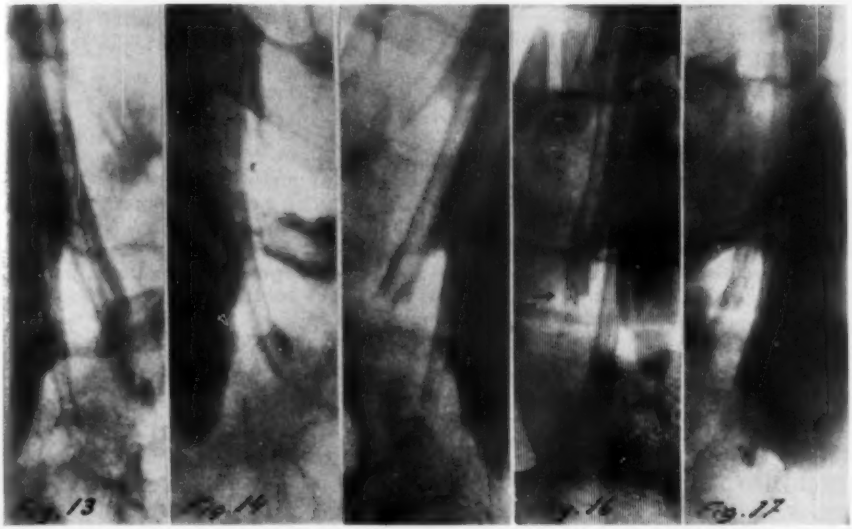
The myelograms showed that the dural sac varied in shape, size and extent (Figs. 13—17). The sac might be narrow and end at the level of the lumbosacral disk, while other cases show a wide sac extending to the fourth sacral vertebra. The end of the sac might be funnelled or rounded, and a diverticulum of the subarachnoid space might be seen at the end of the dural sac. Thus, as an analogy, it can be understood that the space projecting along the roots might even vary in size and shape. A wide ending of the subarachnoid space may be considered as a normal variation.



Figs. 8—10. Roentgenograms of serial cross sections of three roots from the specimens in Figs. 2, 3 and 5. Note the differences in shape and extension of the communicating subarachnoid space (barium).



Figs. 11—12. Roentgenograms of serial cross sections of the fifth lumbar roots of the specimen in Fig. 4. Note the Rexed cysts (X) and other spaces not communicating with the main subarachnoid space (barium).



Figs. 13—17. Myelograms with abrodil demonstrating details of the shape of the subarachnoid space at the roots: septa, projecting tips, diverticula like widenings. In Fig. 16 a minute filling defect (arrow) which is more similar to the Rexed cyst in Figs. 4 and 7 than is the diverticula like widenings of the subarachnoid space in Fig. 14.

The specimens as well as the myelograms demonstrated that there is no symmetry in size, shape, and extension of the closed or communicating subarachnoid spaces of the both sides.

SUMMARY

A roentgenographic and anatomic study of the subarachnoid space at the lumbar nerve roots shows that there are great variations. The subarachnoid space ends with small processes distal to which there might be cysts and fissures (REXED) filled with a clear and colorless fluid. No communications were found between the main subarachnoid space and these cysts and fissures. Such bulges of the subarachnoidal space which are sometimes seen on myeolograms (ARNELL), may be explained as normal variations of the shape of the dural sac.

ZUSAMMENFASSUNG

Eine röntgenographische und anatomische Studie des Subarachnoidalraumes an den lumbalen Nervenwurzeln ergibt das Vorkommen grosser Schwankungen. Der Subarachnoidalraum endet in kleinen Ausläufern, und distal von diesen können Zysten und andere spaltförmige Höhlen vorhanden sein (REXED), die eine klare und farblose Flüssigkeit enthalten. Zwischen dem eigentlichen Subarachnoidalraum und diesen Zysten und Spal-

ten liess sich keine Verbindung nachweisen. Die manchmal an Myelogrammen beobachteten Erweiterungen des Subarachnoidalraumes (ARNELL) lassen sich als normale Variationen der Form des Durasackes erklären.

RÉSUMÉ

D'une étude radiographique et anatomique de l'espace sous-arachnoïdien au niveau des racines lombaires il ressort que celui-ci présente de grandes variations. L'espace sous-arachnoidien se termine par de petits prolongements au-delà desquels peuvent se trouver des kystes et d'autres cavités en forme de fentes (REXED) remplis d'un liquide limpide et incolore. Aucune communication entre l'espace sous-arachnoïdien proprement dit et ces kystes ou ces cavités en forme de fente n'a pu être mise en évidence. De telles dilatations de l'espace sous-arachnoidien, qu'on observe parfois sur les myélogrammes (ARNELL) peuvent s'expliquer par des variations normales de la forme du sac dural.

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FROM THE RADIUM CENTER, COPENHAGEN, DENMARK. (CHIEF: JENS NIELSEN, M. D.)

TREPHINE BIOPSY, ESPECIALLY IN BREAST CANCER[1]

by

Sigvard Kaae, M. D.

In all cancer therapy, the histologic diagnosis is of primary importance. In cases where the diagnosis is beyond doubt and the patient has been operated upon, the preparation obtained by the operation is sent to be examined histologically; if the case is to be dealt with by irradiation a biopsy must be done in order to obtain a histologic diagnosis. In the early stages of cancer this is often the only way in which a safe diagnosis can be obtained. I shall not here discuss the risk of a cancer spreading as result of the procedure, but even if one would rather avoid opening a closed cancer in order to secure a specimen for examination it will often be the only possible means of getting the diagnosis established beyond doubt.

There are four possible ways of obtaining a biopsy from a closed cancer: by complete extirpation of the tumor, by excision of a specimen of the tissue, by aspiration biopsy or by trephine biopsy. Extirpation of the whole tumor for microscopic examination may no doubt be indicated in some special cases, but is outside of these hardly to be recommended. By excising a specimen one may obtain a large piece of tissue for examination, but the method is a little more laborious than either aspiration- or trephine biopsy. Nevertheless it is the best method when those others fail or cannot be made use of. A drawback to the procedure is, however, that it often results in considerable scar formation in the tumor tissue, which may cause difficulties if one wishes to make further biopsies later, during the irradiation. Moreover, many clinical experiences seem to show that the neoplastic tissue is less amenable to radiation therapy when the cancer cells are imbedded in poorly vascularised, fibrous tissue. Therefore it may sometimes be inadvisable to make excision when such a therapy is intended, for instance in the case of lymphogranulomatosis, or of cervical lymph node metastases from a rhinopharyngeal cancer where no sure diagnosis could be made from the primary tumor.

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Aspiration biopsy is much more uncertain. Especially in the case of more fibrous cancers it is often impossible to get tissue for microscopy, and even if one succeeds in getting a fragment it will often be so small that though it may enable one to diagnose the case as cancer it is altogether impossible to determine the exact type of growth.

Trephine biopsy was introduced at the Radium Center in Copenhagen in the latter part of 1939, and the technic has been described by HARALD CHRISTIANSEN. By this method a sharply cut out, cylindric piece of tumor, sufficiently large for thorough study, is obtained without risk of seriously injuring the tissue and thus producing scar tissue. The operation seldom presents any technical difficulties. It is usually carried out under local anesthesia; in the case of biopsy on bones a brief general anesthesia is as a rule induced. After a small incision has been made in

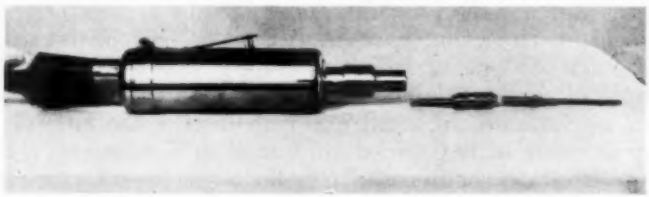

Fig. 1. Trephine with middle piece and hand-electromotor sufficiently powerful for boring in bone.

the skin, the trephine is bored into, or perhaps right through the tumor. Trephines of various diameter have been used, but the model usually preferred is one with a lumen of 2.5 mm. Ordinarily a trephine with a straight cutting-edge is used, only for boring through hard bone it is best to use one with a »drilling-crown». The trephine is rotated by means of a small electromotor, for instance of the type used by dentists. For boring through hard bone a somewhat more powerful electromotor is required, though (Fig. 1). After the tumor tissue has been bored into (Fig. 2) the trephine is detached from the rest of the apparatus, and a 20 c.c. record syringe is screwed on, with the piston pushed all the way down. The piston is then drawn back, thus producing a strong suction (Fig. 3), the object being the double one of loosening the cut-out cylinder and of keeping it in the trephine while the latter is being drawn out under steady suction on the syringe. In this way a cylindric piece of tumor tissue is obtained, which, with the size of trephine usually employed, is about 2.5 mm in diameter and 0.5 to 3 cm long.

Since trephine biopsy was introduced at the Radium Center the method has been used there in about 7,000 cases. It has been used there routinely in all cases where it was wished to obtain a specimen from

Fig. 2.

Fig. 3.

Fig. 2. Showing the trephine bored into a mammary tumor.
Fig. 3. Trephine with record syringe attached. Vacuum produced by pulling the piston rod back before the trephine is pulled out.

a closed tumor accessible for boring, especially breast tumors, lymph node swellings in the neck, axillae and groin, and other tumors in the subcutis, muscles, and bones of the pelvis and extremities. The boring sometimes results in slight suggillation, but only in one case did a hematoma develop which was so large that it eventually had to be emptied. In all other cases such bleeding as was produced always ceased after a brief compression. In one instance, in boring into the inguinal glands the trephine entered the femoral artery, but also in this case the hemorrhage was soon arrested by compression.

Also in spinal diseases where the diagnosis could not be established with certainty in any other way, trephine biopsy, usually from the body of a vertebra, has been used with good result. In these cases the boring was done, usually without use of a »drilling crown», over a cannula introduced as guide to the direction, the cannula's position being controlled by roentgen examination, whereupon its head is nipped off. In this way, biopsies of the spine have been done without complications in 20 cases, only in a few of which two borings had to be made in order to obtain a satisfactory result.

In prostatic affections a specimen for examination is readily obtained with trephine, the boring being done from the perineum inwards to a little away from the midline (in order not to injure the urethra). Also here the boring is done over a guiding cannula, inserted under control of a finger in the rectum. There is some risk of injuring the vesica (this happened in 4 of our cases), but with exception of hematuria there has been no complications. In cases where there were difficulties with the micturation a catheter à demeure has always been laid in, however, if the trephine had entered the vesica. Biopsy of the prostate has been done

in 18 cases, on a total of 16 patients. Cancer was found in 13 of these, while 2 of the others, to judge from the subsequent clinical course, have hardly had prostatic cancer.

Trephine Biopsy in Breast Cancer

In order to test the value of trephine biopsy as a means of obtaining the correct histologic diagnosis in breast cancer, I have analysed a material of 284 such cases from the period 1940—43, during which trephine biopsy was done routinely in all non-ulcerating cases even if the cancer was clinically certain; preoperative roentgen treatment being applied in the operable cases, which made it desirable to get a histologic diagnosis before that treatment was instituted. All cases are included which were technically operable at the first trephine biopsy and in which the diagnosis had not been established histologically already before the patient was relayed to the Radium Center. As all the cases by now have an observation time of over 4 years from the biopsy it is unlikely that any should have occurred in which the biopsy failed and the correct diagnosis was not established later. Of the 284 cases, 275 were breast cancer with palpable mammary tumor, 4 breast cancer with palpable axillary lymph node involvement but without palpable mammary tumor, 5 Paget's disease of the nipple without palpable mammary tumor.

Breast Cancer with palpable mammary Tumor. As will be seen from Table I, the trephine biopsy showed positive cancer in 92 per cent and

Table I

Showing the Results of first Trephine Biopsy in 275 Cases of technically operable Breast Cancer. (In 11 of the 15 Cases in which the first Attempt failed to show any Sign of Cancer, a second Trephine Biopsy was immediately done, with the Result that Cancer was demonstrated.)

Histologically certain cancer in	253	cases	= 92 per cent
Changes causing suspicion of cancer in	7	»	= 2.5 » »
No signs of cancer in	15	»	= 5.5 » »

aroused suspicion of cancer in 2.5 per cent of the cases, while in 5.5 per cent there was no indication of the disease. In the suspected cases, the diagnosis was eventually confirmed histologically. The first boring thus failed to show cancer in 15 cases. In 12 of these, the extracted sample contained only adipose tissue or adipose plus a very slight amount of connective tissue. In such cases one must understand that the trephine biopsy has failed technically, inasmuch as no sample of the tumor has been obtained (unless it is a lipoma), and a second boring must then be

done. In 2 cases, connective tissue poor in nuclei, with a few normal acini and efferent ducts, was found, and in the fifteenth case typical fibro-adenomatosis. In these cases, the tissue obtained was thus not from the cancer, but from the adjacent glandular tissue. When the biopsy has not shown cancer, one must make up one's mind as to whether the sample obtained is from the parts aimed at or not, and in case of doubt a fresh boring must be done at once. Such a second boring was done in 11 of the 15 cases in which the first attempt had failed, and in all the eleven with the result that the specimen now obtained showed cancer. In 2 other cases the whole tumor was extirpated instead, and cancer demonstrated, while in 2 cases, which clinically did not arouse any suspicion of cancer, the trephine biopsies were not repeated until respectively 4½ and 8 months after the first attempt, and in both of them cancer was now ascertained.

Though the result of the first trephine biopsy thus in 15 cases — *i. e.* in 5.5 per cent of the whole material — was negative as regards the demonstration of cancer, it was only in the 3 cases (= 1.1 per cent) in which the specimen contained nothing but normal mammary, or fibro-adenomatous, tissue that the microscopy justified the conclusion that cancer was not present. Only in 2 cases was no second biopsy done at once; thus the result of the trephine biopsy only caused delay in the diagnostication of the cancer in 0.7 per cent of all cases.

All the trephine biopsies were done by the members of the radio-therapeutic staff of the Radium Center, to the number of 18 in all, most of them by assistant radiotherapists, some of them by interns. In order to examine to what extent practical experience with the method plays a rôle for the result, I have divided the 258 cases with regard to which it could be positively ascertained by whom the trephining was done, into 3 groups according to the number of times the different radiotherapists performed the operation (see Table II). In Group I is placed only one,

Table II

Showing the Influence of practical Experience with Trephine Biopsy on the Results in technically operable Breast Cancer.

Trephinings performed by	Positive Cancer	Suspicion of Cancer	No Signs of Cancer
1 highly trained operator	94 per cent	2 per cent	4 per cent
2 moderately practised operators	93.5 » »	0 » »	6.5 » »
15 no- or little practised operators	87.1 » »	3.2 » »	9.7 » »

the most practised operator, who did the trephining in 150 of the cases; in Group II 2 somewhat less experienced, who trephined in 46 cases, in Group III 15 with no or little practice in the method, who did the boring

in 62 cases. As might be expected, skill in the performance of the operation plays a considerable rôle for the result, but already with a modicum of practice noticeably better results are obtained. This is best seen by looking at the cases in which no signs of cancer were found at the first boring. In all the cases under Group II and III the samples recovered contained only adipose, with perhaps a very slight amount of connective, tissue. Thus, the negative results in these cases were evidently due to faulty technic, inasmuch as only subcutaneous tissue was obtained.

In order to find out to what extent the result depends on the size of the mammary tumor, I have divided the 270 cases in regard to which the case records give sufficiently precise information about the size at the time of the first boring, into 3 groups (see Table III). As might be

Table III

Showing the Results of Trephine Biopsy with various Sizes of Tumor in technically operable Breast Cancer.

Size of Tumor	No. of Tumors	Positive Cancer	Suspicion of Cancer	No Signs of Cancer
> 6 cm	48	95.8 per cent	0 per cent	4.2 per cent
4—6 cm	154	93.6 » »	1.9 » »	4.5 » »
< 4 cm	68	86.8 » »	4.4 » »	8.8 » »

expected, the boring is more apt to fail in the case of the small tumor than in the case of a medium-sized or large, therefore one should be more hesitant about relying on a negative microscopy in the case of a small growth, because it requires greater practice in the case of the latter to be sure of having obtained a tissue cylinder form the tumor itself. The material contains 8 mammary cancers whose largest diameter did not exceed 2 cm. In 6 of them, the first trephine biopsy showed cancer, in 1 it aroused strong suspicion of cancer, whereupon the case was treated as such with preoperative roentgen treatment and the subsequent operation confirmed the diagnosis; in 1 case only adipose tissue was found. In this last case, a second boring was done at once, with the result that cancer was now demonstrated. Even in the case of tumors as small as these there is thus a fair certainty that the correct diagnosis may be obtained by trephine biopsy. Later I have seen a case in which the clinical examination showed the presence of a fibroadenomatous area, but in which the trephine biopsy showed indubitable cancer. At histologic examination of numerous sections of the tissue subsequently removed by operation, no positive signs of cancer could be found, however, but only fibroadenomatosis and some suspicious changes in the epithelium.

Direct excision of a specimen for histologic examination is, of course, a more reliable method than trephine biopsy; but also that may fail

because there not infrequently will be marked fibroadenomatous changes and cancer at the same time, and one by excision may risk to get tissue only from the fibroadenomatous portion of the growth. In a previously published material, with regard to which I made a thorough study of the anamnesis of all the cases for the time prior to their being relayed to the Radium Center, specimen-excision or extirpation of the entire growth had been made in 18 cases before their admission to us, and in 4 of them the microscopy had not shown cancer, the presence of which was only revealed, some time afterwards, by renewed excision for biopsy. This very high percentage of error — 22 per cent — is due, however, to the fact that biopsy had in the first instance only been done in clinically doubtful cases, where fibroadenomatosis had masked the cancer (one case was a reticulosarcoma, though).

Breast Cancer with palpable Swelling of the axillary Lymph Nodes, but without mammary Tumor was found in 4 cases, in all of which metastases to the axillary nodes were demonstrated by trephine biopsy. For 3 of them radical operation was performed. In one of these a fully hazelnut-sized tumor was found, in another a firmer, cancerous area, in the third only fibroadenomatosis — probably, as in the fourth case, which was operated upon, a matter of a small primary cancer in the tail of the breast.

Paget's Disease of the Nipple without palpable mammary Tumor was found in 5 cases, in which trephine biopsy was done trough the central part of the corpus mammae. In 3 of them the biopsy showed positive cancer, in 1 there was suspicion, in 1 no sign of cancer. The last of these cases was treated with roentgen and not operated upon until 18 months later, when cancer was found.

SUMMARY

After discussing trephine biopsy and its uses in general, the author reviews the results obtained by means of the procedure in diagnostication of breast cancer at the Radium Center in Copenhagen. He particularly emphasises the reliability of the method. The technical performance of the trephining is easy, and it requires but slight practice to do the boring with good result in most cases. With increasing familiarity with the instrument, the reliability of the method is very great.

ZUSAMMENFASSUNG

Nach einer Besprechung der Probeexzision mittels Trepans und ihrer Verwendung im Allgemeinen, gibt Verf. eine Durchsicht der in der Radiumzentrale in Kopenhagen bei der Diagnose von Brustkrebs mit dieser Methode erzielten Ergebnisse. Besonders betont er die Zuverlässigkeit der Methode. Die Technik der Entnahme mittels Trepans ist leicht, und es ist nur geringe Übung erforderlich, um die Bohrung in der Mehrzahl der Fälle mit gutem Resultat vorzunehmen. Bei zunehmender Vertrautheit mit dem Instrument ist die Zuverlässigkeit der Methode sehr gross.

RÉSUMÉ

L'auteur discute de la biopsie à la tréphine et de son emploi en général, puis passe en revue les résultats obtenus par ce procédé dans le diagnostic du cancer du sein au »Centre du Radium» de Copenhague. Il souligne en particulier la confiance qu'inspire la méthode. Sa technique est facile, et il ne faut pas beaucoup d'experience pour obtenir un bon résultat dans la plupart des cas. Une fois qu'on est familiarisé avec l'instrument, la sécurité de la méthode est grande.

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RETAINED FOOD REMNANTS IN ESOPHAGEAL DIVERTICULA, RESEMBLING TUMOUR AND DYSPHAGIA IN CASES OF SMALL ESOPHAGEAL DIVERTICULA AT THE BIFURCATION LEVEL

by

Sven Roland Kjellberg

Diverticula can appear in all parts of the esophagus but their site of predilection is the region near the upper and lower esophageal mouths as well as at the level of the bronchial bifurcation. Apart from the congenital type, esophageal diverticula (both traction as well as pressure) are usually supposed not to occur until after the age of thirty. They vary widely in size and we are told that they can reach a size exceeding that of a grape fruit. The difficulties which these diverticula cause vary according to their size and position, but a symptom which they all have in common is dysphagia. Most authors are of the opinion that diverticula should have reached a certain size before they cause trouble. Very small diverticula, especially if they are at the level of the bifurcation, are not considered capable of giving any disturbance and they are regarded — at least roentgenologically — as being a purely coincidental discovery. As there was every reason to doubt this, I made a careful examination of our esophageal material for the past three years. The task, however, was limited to include only all the diverticula that occurred at the level of bifurcation. From this it was apparent that difficulties in swallowing occurred even in cases of small esophageal diverticula and also that the dysphagia occurred very much more frequently than is stated in the literature. Very often the anamnesis was so typical that, from this alone, one could suspect the presence of a diverticulum. Of 33 cases with small diverticula (varying in size from that of half a pea to that of a hazel nut) no less than 21 of them had difficulties in

[1] Submitted for publication, Nov. 3, 1948.

swallowing of a characteristic type. Every one of them stated that swallowing difficulties occurred at well defined periods over a rather long time. The patients could be free from trouble for long stretches but the episodes of dysphagia would occur in direct connection with the eating of more solid or doughy food or from faulty mastication. On the other hand they never experienced any trouble after having eaten liquid food. Many times the trouble disappeared if the patients had rinsed the esophagus with water. It seems that the cause of this trouble could be attributed to the solid food (bits of apple, seeds, bits of meat etc.) stuck in the diverticulum and remaining there for longer or shorter times.

Esophagoscopy repeatedly revealed a slight esophagitis which was thought to have been caused by irritation of the mucous membrane from retained food. This can at times explain why the patient experiences difficulty in swallowing, but another cause for the dysphagia can be attributed to the retained food which not only filled the diverticulum but that it even caused the esophageal lumen to curve inwards and become obstructed.

It quite frequently occurred that when the patient was being roentgen examined he was found to be entirely free from symptoms due to the fact that he had managed either to rinse the remnants of food away from the diverticulum or else that he had only eaten suitable food for some time previous. Occasionally, however, it happens that the food remnants still remain in the diverticulum during examination and even cause the esophageal lumen to curve inwards seriously. As will be seen from the figures below, the esophagram can assume a strikingly tumour-like appearance so that, roentgenologically, it is practically impossible to differentiate these food remnants from an incurving polypous tumour. It is possible that the esophageal wall being flexible and variable right up to the incurving defect, might arouse suspicion of the presence of a diverticulum provided of course that there is no complicated esophagitis present. It is only when the actual diverticulum has been established that a certain diagnosis can be made: this will be seen in case 2 below. In both cases a tumour was suspected at the first roentgen examination but when a check examination was made shortly afterward, the patients then being free from trouble, a diverticulum was observed instead.

Case 1. Married woman aged 66 years who had complained periodically of difficulties in swallowing for the past three years. These swallowing difficulties usually came on after having eaten an apple, poorly baked bread or if she had been careless when masticating her food. If, on the other hand, she shredded the apple, ate well-baked bread or liquid food she experienced no difficulties at all in swallowing. In connection with these difficulties in swallowing she experienced pains which radiated out to her arms simulating those of angina pectoris. Shortly before the patient came to the roentgen department she had eaten an apple. The esophagram (fig. 1) shows a contrast defect in contour of about 2 cm in length resembling a tumour immediately below the bifurcation. The con

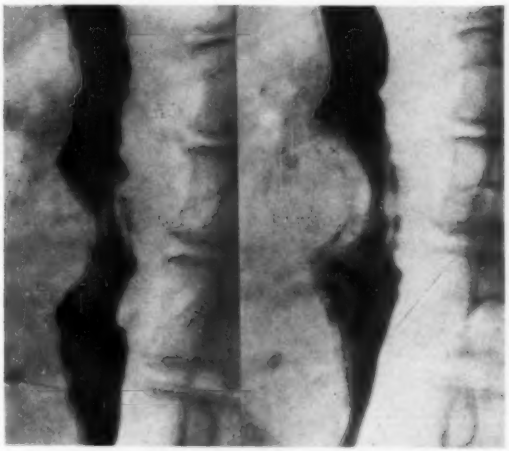

Fig. 1. On a level with the bifurcation a contrast defect can be seen in the esophagus resembling a tumour.

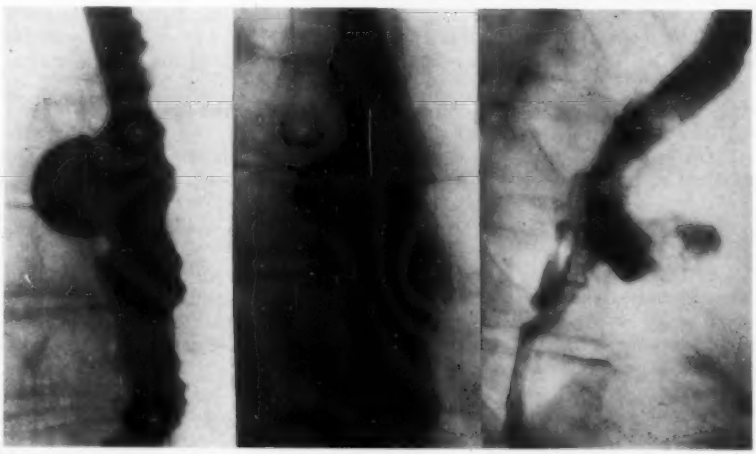

Fig. 2. A check examination one week later shows the diverticulum filled with contrast substance.

tours within this region are rigid and somewhat irregular. A repeat examination six days later showed on the position of this contrast defect a diverticulum as large as a hazel nut (fig. 2). On this occasion the patient experienced no difficulties in swallowing.

Case 2. A 45-year-old woman who, for the past year, has had midsternal pains which increased in intensity when she swallowed. These troubles were periodic and came on especially if she had masticated her food badly or if she swallowed pieces that were too large. Roentgen examination showed a large polypous contrast defect resembling a tumour

Fig. 3. A large polypous contrast defect at a level with the bifurcation.

Fig. 4. A check examination 14 days later shows good filling of the diverticulum.

situated immediately below the bifurcation (fig. 3). A repeat examination 14 days later showed an esophageal diverticulum as big as a hazel nut in the position of the tumour (fig. 4). On this occasion the patient was free from trouble. Esophagoscopy showed a diverticulum of usual appearance which was partially filled with food remnants.

SUMMARY

The author describes two cases having food remnants in an esophageal diverticulum. The esophagrams assume a tumour-like appearance. The author in addition emphasizes that even small esophageal diverticula cause dysphagia of a more marked degree than have previously been pointed out and that in the majority of cases these difficulties are of a markedly periodic character.

ZUSAMMENFASSUNG

Verf. beschreibt 2 Fälle von retinierten Speiseresten in Divertikeln der Speiseröhre. Die Bilder sind tumorähnlich. Verf. betont ausserdem, dass selbst sehr kleine Speiseröhrendivertikel in höherem Grade als früher angenommen Schlingbeschwerden geben, und zwar zumeist Beschwerden von ausgesprochen periodischem Charakter.

RÉSUMÉ

L'auteur décrit deux cas de rétention de débris alimentaires dans des diverticules oesophagiens. Les images ont un aspect tumoral. L'auteur souligne en outre que des diverticules oesophagiens, même très petits, provoquent une dysphagie plus accentuée qu'on ne l'a relevé jusqu'ici, et que celle-ci a le plus souvent un caractère nettement périodique.

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A SIMPLE PORTABLE DENSITOMETER[1]

by

A. Engström, L. Wegstedt and *S. Welin*

The disadvantage of most photometers for the measurement of the density of photographic films is that it is not possible, in the course of the measurements, to observe the area measured and thus to localize it. This disadvantage is particularly evident in, for example, the photometry of roentgen films.

With the use of a photomultiplier tube a simple, extremely sensitive photometer has been constructed in which the forementioned disadvantage is eliminated. The apparatus can also be used for the direct measurement of the intensity of roentgen rays, *e. g.* for the determination of exposure times.

The principle of the photometer is seen in the schematic drawing (fig. 1). Full explanation of the symbols in the text to fig. 1. The film to be recorded photometrically, A, is placed on an illumination box or cupboard B. The photomultiplier D, housed in the light-tight metal cylinder C is connected with a flexible, screened cable to the voltage supply and the recording instrument. By means of the shutter E (an ordinary camera shutter) light can be let into the multiplier. The light passes through a pin hole in I. I is cone-shaped at the end, so that when the film is lying on the light box, this cone can be placed at that point on the film of which the density is to be measured. The hole in I, which determines the size of the surface to be measured by the photometer, can be varied by different pinholes from 0.2 mm in diameter and upwards. The diameter is selected according to the structure to be measured. It is preferable to place a small lens at the inner end of the hole I, so that the light is spread over the whole photo cathode in the multiplier tube. This construction makes it possible at the same time as the film is examined, to measure the density directly at selected points and to obtain an accurate localization of the area measured.

The wiring diagram for the high voltage D. C. supply, from 220 V A. C. line is shown in fig. 2. The photomultiplier used is RCA 931 — A or 1P 22.

This D. C. generator delivers well-stabilized high voltage.

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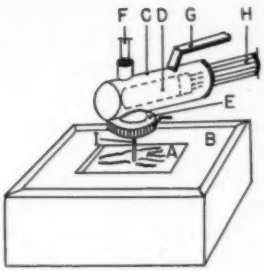

Fig. 1. Schematic drawing of the photometer (densitometer). A Film to be recorded. B Illumination box. C Metal envelope for the photomultiplier tube. D Photomultiplier tube RCA 1P22 or 931 A. E Shutter. F To recording instrument. G Handle. H From voltage divider. I Pin hole to limit the area on the film to be measured.

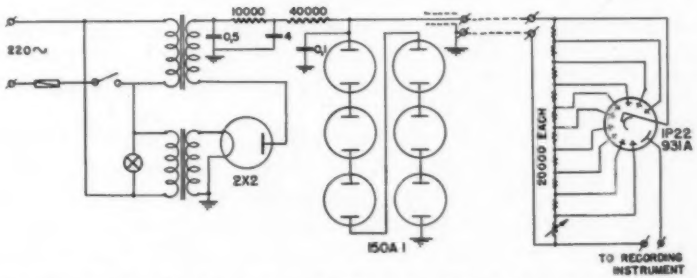

Fig. 2. Voltage supply for the photomultiplier tube. The high voltage from the transformer is rectified in the tube 2X2 and stabilized in the six tubes 150 Al. The total voltage on the phototube is 900 volts D. C. The voltage on each plate (dynode) in the photomultiplier is 80—90 volts. Resistances are given in ohms and capacities in μF.

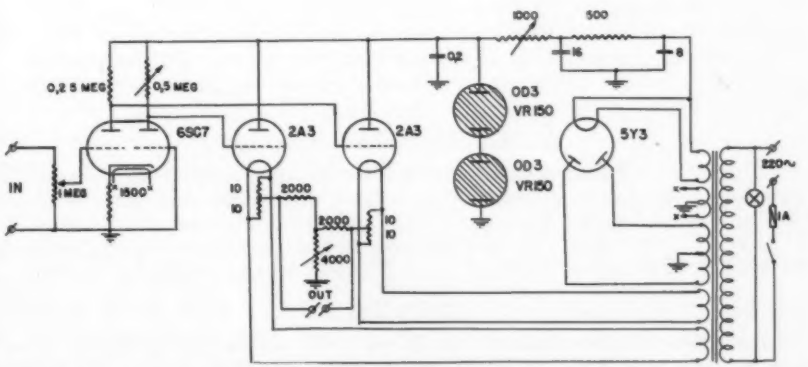

Fig. 3. Amplifier for the current from the photomultiplier when recording instruments which require more than 250 μA are used. Resistances are given in ohms and megohms and capacities in μF.

Since the multiplier tube constituting the light-sensitive part of the densitometer is portable, the voltage divider is placed in a small box very near the multiplier, because it is difficult using reasonable dimensions to construct a high voltage lead, with many wires for the relatively high tension (up to 1,000 volts). Anode batteries could also be used, for voltage supply.

The current from the photomultiplier tube is measured with a multiflex galvanometer (spot light galvanometer). In order to obtain high stability and linearity the current for the recording instrument should not exceed 250 μA. When the recording instrument requires higher intensities, *e. g.* when using a self-recording instrument, a simple amplifier (wiring diagram in fig. 3) is coupled to the multiplier tube.

In order to obtain satisfactory stability the intensity of the light from the light box must be kept constant, for example with a constant voltage transformer. In the model apparatus the current for the lamp in the light box is taken from a storage battery.

When the apparatus is used for direct measurement of the intensity of roentgen rays, the aperture of the photomultiplier is covered with a black paper. The glass envelope outside the photo cathode in the multiplier tube is coated with some fluorescent mass, such as calcium tungstate, willemit or activated zinc-cadmium sulphide. If the fluorescent light from this mass is collected with a concave mirror and the wave length of the light emitted corresponds to the maximal spectral sensitivity of the photomultiplier the apparatus will be only slightly less sensitive than the Geiger-Müller counter for the measurement of roentgen rays.

SUMMARY

A simple densitometer using a photomultiplier is described. It is possible with the apparatus to measure the density at the same time that the film is observed visually. By introducing a substance fluorescent for roentgen rays over the photo cathode, the apparatus can be used for direct measurement of the intensity of roentgen radiation with high sensitivity.

ZUSAMMENFASSUNG

Ein einfacher Schwärzungsmesser mit Verwendung eines Photomultiplikators wird beschrieben. Mit diesem Apparat ist es möglich, die Schwärzung unter gleichzeitiger visueller Beobachtung des Films zu messen. Durch Anbringen einer für Röntgenstrahlen fluoreszierenden Substanz über die Photokathode kann der Apparat zu sehr feinmerkender direkter Messung der Intensität einer Röntgenstrahlung verwendet werden.

RÉSUMÉ

Description d'un densitomètre simple, qui utilise un photomultiplicateur. Avec cet appareil il est possible de mesurer la densité tout en observant, par la vue, le film. Si l'on introduit, au-dessus de la photocathode, une substance fluorescente aux Rayons Roentgen, l'appareil peut servir à mesurer directement, et en faisant preuve d'une grande sensibilité, l'intensité des radiations.

FROM THE ROENTGEN CLINIC OF THE STATE HOSPITAL, COPENHAGEN, DENMARK
(CHIEF: PROF. P. FLEMMING MØLLER, M. D.)

THE ROENTGENOLOGIC PICTURE OF CONGENITAL SYPHILIS, ESPECIALLY IN INFANCY[1]

by

P. Flemming Møller

Just as the roentgenologic picture of the tabetic arthropathies in the years before the first world war disappeared almost completely from the material of the hospitals, owing to the diminished incidence of acquired syphilis, thus congenital syphilis, which in the two first decades of the present century was frequently seen in hospitals of any magnitude, was from the late twenties until the beginning of the forties very rarely met with, at least in Danish hospitals. Consequently very few of the younger generation of radiologists have had occasion to become acquainted with the extremely characteristic roentgenologic picture of this important disease, and as there, moreover, during the last period of the second world war has been a renewed, alarming increase in the number of syphilis cases, I have thought that it might be well to take this subject up for renewed discussion, the more so because the changes in the roentgenologic picture may sometimes be the first, and even, at the instant, the only symptom by which the diagnosis can be established or the suspicion of congenital syphilis be confirmed.

It is often surprising how greatly the clinical picture in this disease differs from the roentgenologic. Not infrequently there will be very pronounced cutaneous changes or changes in the internal organs while the roentgenologic changes are only slight. Oftener, though, the reverse will be the case, with severe osseous changes and only slight clinical findings. Not infrequently syphilis has been ascertained in an infant at roentgen examination for a slight trauma.

Already rather early in the roentgenologic era, in 1900, HOLZKNECHT and KIENBOECK gave the first, fairly exhaustive description of the roentgenologic picture of the disease and pointed out how closely its patho-anatomic picture is reflected in the films. Later, other writers

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— ALBAN KOEHLER, FRAENKEL, HÄNISCH, WIMBERGER and others — have contributed essentially to the further description of the roentgenologic changes.

The roentgenologic picture of the congenital syphilis is in some respects entirely similar to that of the acquired. One finds in both not only, and particularly, the same periostitis, but also the same gummatous changes, hyperostoses and even syphilitic osteitis. The last-named changes appear, however, especially in the later forms of congenital syphilis; and it is important to remember that congenital bone syphilis may sometimes not manifest itself until towards the age of puberty, or even as late as the twenty-eighth year of life or after.

What shall particularly engage our interest here are, however, the syphilitic manifestations in early infancy. These are in the first months of life localised chiefly to the zones of growth, in the form of so-called syphilitic osteochondritis — a term coined by WEGNER, whose study on congenital syphilis, published in 1870, became the basis of our knowledge respecting the pathologic anatomy of the disease. Later, this knowledge, and especially our ability to diagnose the condition, became considerably greater as result of the systematic comparative studies of the pathologic anatomy in congenital syphilis and the roentgenologic appearance of the skeleton, which were begun in the first decade of the present century, and where particularly EUGENE FRAENKEL's investigations broke new ground. Not only did the roentgen examinations prove of immense value because they far better than the microscopic study of preparations were able to reveal even very delicate changes in the structure and calcium content of the spongiosa, but they made it possible to obtain a single, comprehensive view of the whole skeletal system and thus to follow the varying, multiple extensions of the congenital changes so characteristic for bone syphilis. From then on, roentgen examination became an indispensable part of the clinical examination in congenital syphilis.

The osteochondritis is an extremely characteristic, for congenital syphilis almost pathognomonic condition. It may be found developed already by the end of the fifth foetal month — but according to OLUF THOMSEN's investigations never earlier — and it is important to know that it in the newborn, as the so far only sign of congenital syphilis, may be revealed by roentgen examination. I shall not go into details as regards the patho-anatomic picture, but shall only outline its principal features in order to show the interrelation between the patho-anatomic changes and the roentgenologic.

The syphilitic osteochondritis is due partly to insufficient resorption in the provisional zone of calcification, partly to imperfect development of the primary spongiosa, owing to defective activity of the osteoblast.

Fig. 1. Typical osteochondritis syph.

Fig. 2. Osteochondritis with Parrot's pseudoparalysis.

As result of this, the provisional zone of calcification is in the roentgen film not seen, as normally, as a narrow, sharply drawn line, but as an opaque band of greater or lesser width, of sometimes uniform, at other times more uneven density, often sending out extensions towards the epiphysis and thus making the zone of calcification look frayed and perforated also (Fig. 1). Owing to the deficient activity of the osteoblasts back of the zone of calcification, and because the pathologic processes result in the formation, there, of a soft granulation tissue which has a tendency to fatty degeneration, one finds upwards toward the diaphysis, and thus above respectively below the opaque zone of calcification, a more or less distinct, rarefied zone of greater or lesser width, which stands out very clearly in the films.

These phenomena — the broad, densified, as a rule frayed and irregular zone of calcification and the distinct, broad, rarefied zone above it — are what roentgenologically characterise the fully developed syphilitic osteochondritis. But of course also the different degrees of the development of the pathologic processes are reflected in the roentgenologic picture and clearly illustrate the different stages in the development of the disease.

The formation of the soft granulation tissue above the zone of calcification often becomes the cause of displacement of the latter, or even of its becoming completely detached from the diaphysis. When this

Fig. 3. Osteochondritis syph. with large defect in the metaphysis.

happens, it causes a pseudoparalysis of the extremities, the so-called Parrot's pseudoparalysis (Fig. 2). What occurs is really an infraction in the metaphysis, but the phenomenon has been the subject of lively controverse in the literature, some writers, notably represented by HOCHSINGER, believing that it is a matter of detachment of the epiphysis, while others with EUGENE FRAENKEL hold that it is a matter of real fracture. There can be no doubt, however, that the last of these theories is the right one, since the displacement undoubtedly occurs above the epiphyseal line, in the soft granulation tissue formed in the metaphysis. This is clearly illustrated in Fig. 2, which shows the typical osteochondritis in the ends of the diaphyses, with fractures above or beneath the zone of calcification, and the clinical equivalent for this in the form of Parrot's pseudoparalysis.

When the osteochondritis in the young infant is allowed to develop, the soft granulation tissue in the metaphysis may spread very considerably and may show itself as centimeter-broad rarefactions extending up in the diaphyses, not infrequently with a convex delimitation upwards. In such cases, the roentgenologic picture may easily be mistaken for that of osteomyelitis, tuberculosis or tumor. In these severer cases of osteochondritis also the dense calcareous layer at the zone of calcification very often disappears, and the picture may then get some resemblance to that of rickets, so that the diaphysis ends without any demarcation from the epiphysis (Fig. 3).

We may thus distinguish between several types of osteochondritis: the initial stage with the more or less dense and perhaps slightly frayed zone of calcification, which becomes increasingly distinct the more marked the broader, rarefied zone above it is; a stage where the metaphyseal border is still denser, but more markedly ragged and defective and seemingly separated from the diaphysis by a broad, clear margin; and finally a stage where the metaphysis has become con-

pletely obliterated and there is a large defect in the inferior part of the diaphysis (Figs. 4, 4 a, 5). In these last cases there is also gummatous infiltration (Fig. 5), and if the child is a little older there will also be periosteal deposits from the gummatous processes along the shaft of the bone (Fig. 6).

Fig. 4. Initial stage of osteochondritis syph. (new born child).

These *periosteal changes* may also be found in newborn infants, however, but they occur in increasing degree in children in the second to third month of life and in late syphilis. We distinguish between the purely diaphyseal form of periostitis (Fig. 7) and the periostitis arisen from gummata and destructions in the metaphyses or in connexion with syphilitic osteomyelitis (Fig. 6), and of course periostitis also occurs as a reparatory element in the healing of the syphilitic processes.

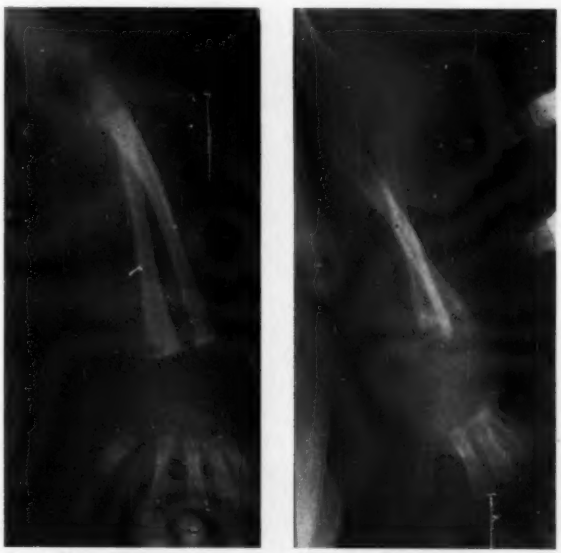

Fig. 4 a. Fig. 5.

Osteochondritis syph. in different stages.

Fig. 6. Osteochondritis syph. with periosteal deposits and gummata.

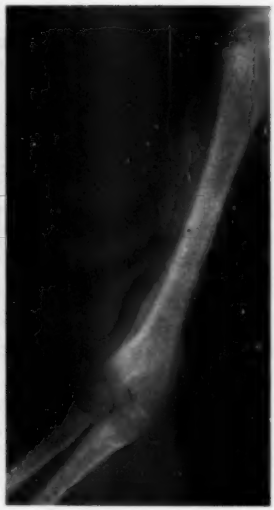

Fig. 7. Pure diaphyseal periostitis syph.

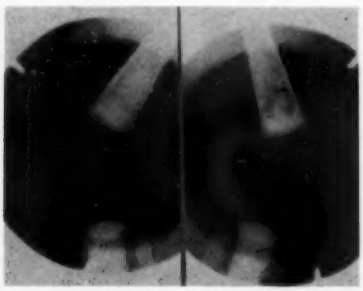

Fig. 8. Gummatous change in a very young infant.

As said, *gummatous changes*, which often develop into true syphilitic osteomyelitis, may be found also in very young infants (Fig. 8), though they are more frequent in children of two to three months or older (Fig. 9). The gumma may be single or occur in the form of more diffuse processes. Its location is often rather characteristic, frequently in the proximal end of the ulna (Fig. 10), but particularly on the inner side of the upper part of the tibia (Fig. 11), where it is not seldom confounded with simple osteomyelitis. It may be situated centrally in the

Fig. 9. Single gumma in an older child.

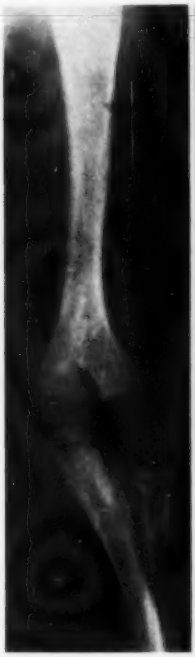

Fig. 10.

Fig. 11.

Characteristic locations of gummata.

Fig. 12. Congenital syphilitic osteitis in the cranium.

Fig. 13. Syphilitic dactylitis.

Fig. 14. Syphilitic dactylitis. Spina ventosa.

bone or be spreading along the cortex, in the latter case it gets the same characteristic appearance as in acquired syphilis, with frayed and ragged edges and delimited by a sclerotic zone. Among other locations of congenital syphilitic osteitis may be mentioned the cranium (Fig. 12), where just as in acquired syphilis great changes may be found, with extensive destructions in the theca alongside with marked sclerotic processes.

Another characteristic manifestation of congenital syphilis is the so-called syphilitic dactylitis or »flask fingers» (Fig. 13). It is an early sign, and is nearly always found together with other syphilitic changes, but according to WIMBERGER its demonstration may be of great clinical importance when other clinical symptoms are uncertain. The dactylitis may then be the only demonstrable sign of syphilis. Only the bones of the finger are involved, the joints are not affected. The occurrence is always multiple and shows itself in a bulb-shaped swelling, especially of the basal phalanges, with a finely or more coarsely spotted rarefaction in the spongiosa. Besides the resorptive changes there are productive ones, with periosteal deposits, usually of markedly sclerotic structure. At the same time there is marked constriction at the collum, whence the appellation »flask fingers».

The differential diagnosis from tuberculous spina ventosa may sometimes be difficult, but as a rule the phalanges will in tuberculosis be more puffed up and centrally rarefied, with very thin periosteal deposits, and usually the highly sclerotic periosteal deposits in syphilis contrast with the pale, more glassy appearance in tuberculosis (Fig. 14). But, as said, the differential diagnosis may be difficult. Still, as a rule the e

will also at the same time be changes, characteristic for syphilis, in other parts of the skeleton (as in Fig. 13).

Fig. 15. Barlow's disease.

It is interesting to see how quickly and readily the syphilitic lesions in the bones heal under suitable treatment. Even extensive osteochondritic processes rapidly subside and imperceptively give way to the normal picture, and it is often surprising to see how even very advanced gummatous processes heal without leaving marked changes in the bones. It is especially in the very young infants, though, that such *restitutio ad integrum* takes place, in older children the restoration is not so complete; in them the periostitis and osteitis, if in any way severe, leave thickenings and deformations exactly corresponding to what one finds in acquired syphilis.

In the young infant, that is to say up to the third or fourth month of life, the diagnosis from other diseases is not difficult. What especially must be paid attention to here is the age of the child, because the syphilitic osteochondritis localised to the metaphysis can hardly be confounded with any other pathologic picture and is hardly likely to be found in its acute stage after the tenth week of life. Thus it is in the first place the age of the child that enables one to establish the differential diagnosis between Barlow's disease and rickets, the two children's diseases of which there chiefly can be question roentgenologically, because the roentgenologic changes in scurvy show a picture in many respects reminding of osteochondritis. For instance, one finds also in scurvy the zone of calcification near the border of the temporary cartilage transformed into a densified margin, but in contrast to what is the case in osteochondritis it is homogeneous, and besides it is narrower often thicker in the middle than towards the edges, and the edges of the diaphyses drawn out into a point, so that the end of the diaphysis resembles a chisel (A. KOEHLER) as seen in Fig. 15.

These changes occur because the normal bone marrow owing to the disease becomes transformed into a poorly vascularised marrow tissue poor in cells, with the result that the bone trabeculae become abnormally brittle. They become pressed together, at the same time as hemor-

Fig. 16. Rachitis.

rhages and accumulation of pigment occur, and it is these small fractures together with the hemorrhages which give the zone of calcification the densified appearance. Besides, there may also in scurvy be a small rarefied zone above the densified, as result of abnormously great resorption of bone there. But in contrast to what is the case is osteochondritis, this rarefied zone is always quite narrow. The subperiosteal hemorrhages in scurvy are homogeneous deposits which give only a faint shadow, and are not stratified densifications as in periostitis.

There are thus many points of similarity between the roentgenologic changes in the two diseases, but with close study they are nevertheless not difficult to distinguish from each other. Besides, scurvy, as we know, does not occur until after the third month of life, and by that time one will hardly any longer find the osteochondritic changes in their characteristic stage. Moreover, there will by then be other syphilitic changes, which can not be mistaken for scurvy. When the age of the child is considered, the differential diagnosis will consequently not be difficult.

The same applies to the diagnosis from rickets. This disease is hardly ever found until after the third month of life, and the only picture which in congenital syphilis may remind of it is in the cases in which the destructions in the metaphysis have been so great that also the zone of calcification has become obliterated (see above, Fig. 3). Later, when the child has reached the age of five or six years and periosteal new growths develop as compensation for the rachitic bends in the diaphyses, these growths may perhaps be mistaken for syphilitic periostitis, but usually the rachitic deformations are so characteristic that it is improbable that an experienced roentgenologist should diagnose them wrongly. A greater difficulty arises if the congenital syphilis is complicated by rickets. In that case one may be guided, however — at least as regards the diaphyseal form of the syphilitic periostitis — by its different location from that of the rachitic. The former is symmetrically diaphyseal, with narrowing of the thickenings towards the ends of the diaphysis, whereas

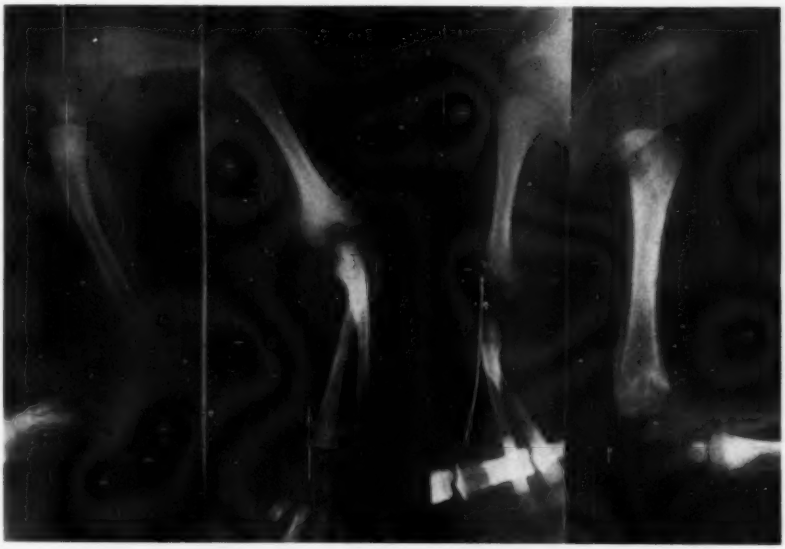

Fig. 17. Fig. 17 a. Fig. 17 b.

Multiple osteomyelitis confounded with congenital syphilis.

the latter, as mentioned above, are situated corresponding to the rachitic bends in the bones (Fig. 16).

The differentiation of syphilitic dactylitis from spina ventosa has already been spoken of. Apart from this form of tuberculosis in bones, confusion with tuberculosis is rare. Confusion with sarcoma is more likely, but if the disease is syphilis an examination of the whole skeletal system will in most cases disclose involvement also of other bones, and will thus establish the diagnosis beyond doubt.

The difficulty becomes much greater when the question is of osteomyelitis in early infancy. The changes in the metaphyses may here be so similar that differentiation on the basis of the roentgen picture alone may be impossible. We have recently had such a case, in which the pathologic condition was misjudged both clinically and roentgenologically. The patient was a child 1 month old, apparently well at birth. On the fifteenth day after it was born, the mother noticed a slight swelling of its left knee — and four days before it was admitted to hospital also the right elbow had become swollen, without any preceding trauma. The mother then brought the baby to the clinic for children's diseases. It looked well, but was rather small. As soon as one touched it it began to cry. There was no cough or coryza, no lymph nodes except in the right axilla. The ab-

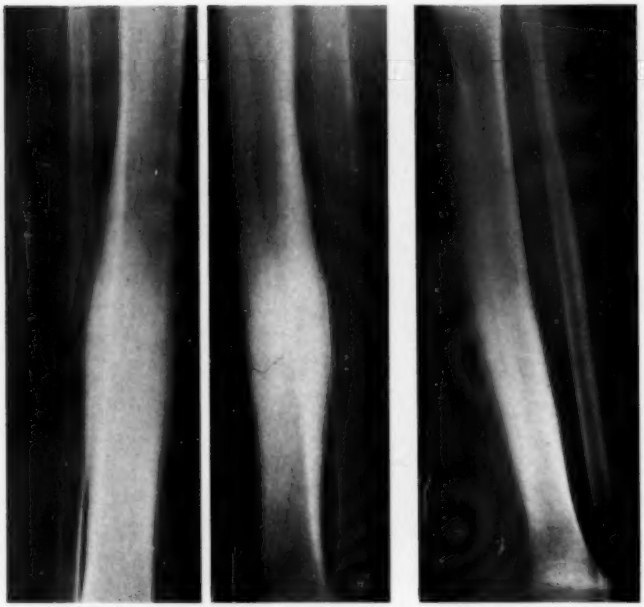

Fig. 18. Late form of osteomyelitis. Fig. 19. Congenital syphilis.

domen was distended, the liver 2—3 finger's breadth below the thoracic margin. The right elbow and the distal part of the upper arm were somewhat swollen, and there was swelling also of the left knee. The left lower extremity was held fixed. There was no fluctuation. No fever. The child was admitted for observation in suspicion of possible congenital syphilis, and was sent for roentgen examination. This examination showed a rather large defect in the distal metaphysis of the left femur and a periosteal deposit upward along the shaft of the bone (Fig. 17). In the right olecranon there was a thickening and destruction at the point where the syphilitis so often first manifests itself, besides, there were changes, similar to those in the left femur, in the distal metaphysis of the right humerus (Fig. 17 a). It was also thought that there was a slight thickening of the zone of calcification in the metaphysis of the lower arm, and it was believed that the case must be one of congenital syphilis. Wassermann, however, proved to be negative, the parents emphatically denied the possibility of syphilis, and also their Wassermann reactions were found to be negative. The patient was then sent for repeated roentgen examination 8 days later (Fig. 17 b). By then, the swellings of knee and elbow had increased considerably. The destructive processes had spread, and

also the periosteal deposits had markedly increased. In view of the clinical observations it was now believed that the diagnosis of syphilis could no longer be maintained, but then it must be a case of osteomyelitis with multiple foci. Moreover, a puncture of the tumor over the knee produced pus. The roentgenologic picture absolutely resembled most of all that of congenital syphilis with pronounced syphilitic granulations in the metaphysis, and the multiple occurrence of the changes supported this interpretation. But, as we see, it turned out to be a case of osteomyelitis, which shows that the diagnosis also in early infancy may be difficult when the changes in the zones of calcification typical for osteochondritis as here, are not present.

I have also, many years ago, seen a case which at the first examination was diagnosed as osteomyelitis, but which eventually was found to be syphilis. Here, the changes were localised to one site only, but the correct diagnosis ought nevertheless to have been established at once (Fig. 3).

Also the differentiation between late osteomyelitis, sclerosing, not puriform osteomyelitis and late syphilis, by roentgen examination alone, may be extremely difficult, or even impossible. When one is confronted with a picture like Fig. 18 it is impossible to say whether it represents a case of congenital syphilis or a late form of osteomyelitis. In such cases the possibility of syphilis should always be borne in mind, and can not be excluded unless a Wassermann test has been made and has proved negative. The patient in this case, a boy 14 years old, had sustained an injury some months previously, and now came to us with this fusiform thickening of the tibia. The diagnosis of congenital syphilis was contemplated, but Wassermann was negative. He was therefore sent home, with injunction to come again a month later. The renewed roentgen examination now showed a suggestion of rarefaction in the thickened part of the bone, and thus confirmed the diagnosis of osteomyelitis. Subsequent operation also disclosed a small pus focus, and when one compares this picture with Fig. 19, which is a clinically diagnosed case of congenital syphilis with strong Wassermann reaction, one readily understands that a diagnosis on the basis of the roentgen picture alone is not possible.

Altogether, the differentiation between congenital late syphilis and other affections of the bones is considerably more difficult than the differentiation between these and syphilis in the very young. This is because the appearance of the congenital syphilis in the more advanced age is not essentially different from that of the acquired, and because the roentgenologic picture of the latter may be so polymorphous that there is, so to speak, no affection with which it may not be confounded. Those which should be particularly borne in mind, however, are osteomyelitis, tuberculosis and tumors, and, as regards the acquired syphilis, Paget's osteitis deformans.

SUMMARY

After reviewing the roentgenologic picture of the congenital syphilis, especially in infants, and mentioning the different forms in which the disease may occur, the author stresses the importance of being able to establish the diagnosis, because the roentgenologic changes not infrequently at the instant will be the only signs of the presence of the disease. Finally, he discusses the differential diagnosis and points out that in infants especially the differentiation from osteomyelitis may be difficult.

ZUSAMMENFASSUNG

Nach Besprechung des Röntgenbildes der kongenitalen Syphilis, besonders bei Kindern, und Erwähnung der verschiedenen Formen, in denen die Krankheit auftreten kann, betont Verf. die Wichtigkeit dieser Möglichkeit zum Stellen der Diagnose, da die röntgenologischen Veränderungen zu dieser Zeit nicht selten die einzigen Anzeichen des Vorliegens der Krankheit darstellen. Schliesslich erörtert er die Differentialdiagnose und macht darauf aufmerksam, dass bei Kindern besonders die Unterscheidung von der Osteomyelitis schwer sein kann.

RÉSUMÉ

Après avoir passé en revue les images radiologiques de la syphilis congénitale et mentionné les differentes formes sous lesquelles la maladie peut se présenter, l'auteur souligne l'importance de savoir en poser le diagnostic, parce qu'assez souvent les altérations radiologiques, à un moment donné, seront le seul signe de la présence de l'affection. En terminant, il discute du diagnostic différentiel et fait ressortir que, chez les enfants en bas âge spécialement, la distinction de l'ostéomyélite peut être difficile.

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FIBRO-OSTEOMAS OF THE PARANASAL SINUSES, ROENTGENOLOGICALLY SIMULATING MALIGNANT NEOPLASMS[1]

by

Sölve Welin

BILLING and RINGERTZ (1946) published a very extensive article in this journal on the so-called fibro-osteomas. They laid particular stress, *inter alia*, on the existing possibilities for the radiological diagnosis of these formations. They pointed out in this connexion that in cases of atypical localization in which a lower degree of maturation or widespread degenerative changes in the formation pertains the diagnosis may be difficult if not impossible.

In their material (25 cases) the processes were in no less than 22 cases localized to the bony skeleton of the face. When the regions of the frontal sinuses or of the ethmoid air cells were involved, there was often very low differentiation. In these cases the roentgen picture had as a rule shown a homogeneous shadow, denser than the soft parts but thinner than bone. In addition there was usually a picture of pressure atrophy of the surrounding bone.

In localization to the maxillary bone in which the processes usually originated in the tuber maxillae, the forementioned writers found that the entire bone was usually diffusely enlarged and the maxillary sinus completely obliterated.

At Karolinska Sjukhuset we have had three cases of fibro-osteoma verified by biopsy where, in the two cases in which they were localized to the maxillary sinuses, extremely pronounced destruction of the bone was visible radiologically. In the third case localized to the region of the ethmoid air cells this was somewhat less pronounced. All three cases caused considerable difficulty in the differential diagnosis and certainty was only obtained when it had been verified by biopsy.

Since, as far as I am aware, no report has hitherto been published in which the destructive factor was the most evident in this disease, and

[1] Submitted for publication, Oct. 21, 1948.

knowledge of this possibility is of considerable importance both from a theoretical and practical viewpoint, I consider it justified to report these three cases.

Case 1. ♂ aged 13 years. J. 49/40.

Persistent rhinitis for many years. Pronounced nasal obstruction on the left side and bilateral lacrimation for the past year.

Nasoscopy: On the left side an extremely swollen middle nasal concha with the septum bulging over onto the right side. Its mucous membrane was firm, pale grey and with small granulations.

Roentgen examination: Massive diffuse density over the left ethmoid aircell region, left maxillary sinus and left nasal cavity. The bone septa in the ethmoid aircell region are not apparent and the medial wall of the maxillary sinus is partially lacking (fig. 1).

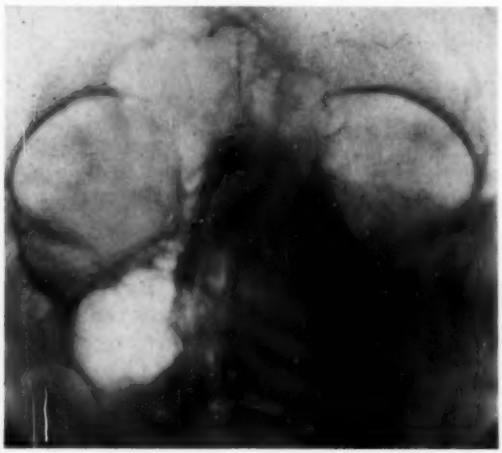


Fig. 1. (Case 1.) Massive diffuse density covering the left ethmoid air cell region, the left maxillary sinus and the left nasal cavity. The bone septa in the ethmoid air cell region are not apparent and the medial wall of the maxillary sinus is partly lacking.

Pathologico-anatomical examination of sample biopsy from the middle concha:

»Fibroblast mass fairly rich in cells with somewhat whorl arrangement, and fairly scanty development of collagen substance. Contains large and smaller spherical calcified foci. No definite grounds for malignancy. Fibro-osteoma.»

Operation: »The bone in the anterior wall of the maxillary sinus is softer than normal. Considerable bulging inward of the thin and almost transparent medial wall of the maxillary sinus. The entire left ethmoid air cell region is occupied by a soft, reddish-grey tumour the size of a hen's egg, with the dura exposed in an area the size of a bean laterally in the roof of the ethmoid bone.»

Case 2. ♂ aged 14 years. J. 2161/46.

For the last three months increasing swelling over the left cheek. No nasal discomfort. After roentgen examination at the local hospital, the patient was referred to Karolinska Sjukhuset for suspected cancer.

Condition on admission to Karolinska Sjukhuset: Firm swelling, the size of a walnut, in the anterior left wall of the maxillary sinus. No tenderness.

Roentgen examination: Massive diffuse density over the left maxillary sinus and the ethmoid aircell region in addition to considerable destruction of the medial and lateral walls of the maxillary sinus and its entire floor. The wall of the maxillary sinus appeared to have been deviated outwards in an arch before it became the site of the destructive process (fig. 2).

Following pre-operative roentgen therapy, a sample biopsy was taken after opening the maxillary sinus.

Pathologico-anatomical examination: »Tumour tissue with a structure in principle resembling a fibro-osteoma but with cavernous haemangiomatous infiltrations. No grounds for malignancy. Fibro-osteoma.»

Operation: Extirpation of tumour in the left maxillary sinus. Anteriorly and laterally definitely eroded bone. Maxillary sinus filled with polypous masses and sawdust-like tumour tissue. The tumour, which has an almost rind-like covering is chiefly localized medially and anteriorly and has eroded the medial superior wall of the maxillary sinus.

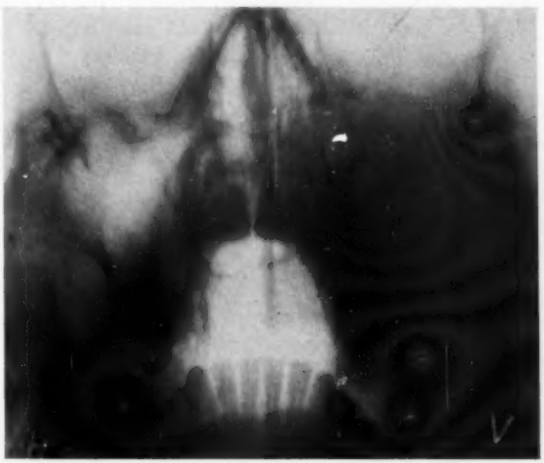


Fig. 2. (Case 2.) Massive diffuse density covering the left maxillary sinus and considerable destruction of its walls. The upper part of the lateral wall of the maxillary sinus is dislocated outwards in the form of an arch.

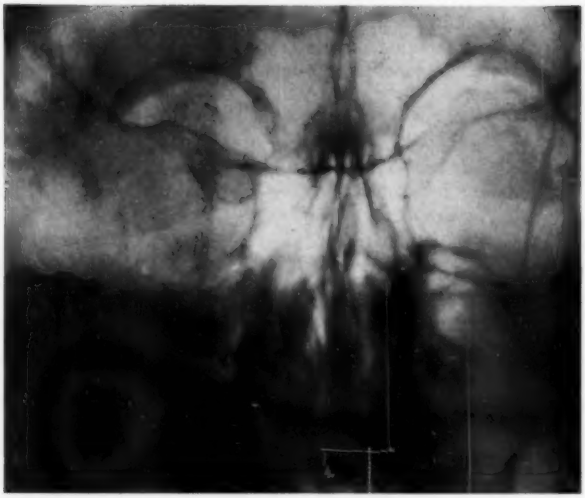
Case 3. ♂ 54 years old. J. 413/47.

For many years increasing depression of right cheek, chiefly in the region of the zygomatic arch. No pain.

Condition on admission to Karolinska Sjukhuset: The zygomatic region on the right side is considerably sunken compared with the left. The right eye is somewhat deviated downwards. The alveolar process in the right upper jaw is markedly increased in breadth on the medial surface. On palpation it is as hard as bone throughout.

Roentgen examination: The right maxillary sinus is the site of bone destruction so extensive that the bony walls are almost completely lacking. The destructive process extends as far as the zygomatico-frontal suture and even involves the entire anterior part of the ala magna. (Fig. 3, 4 and 5.)

Operation: Radical Denker operation: »The bone in the canine fossa is completely lacking and replaced by a relatively thick, fibrous membrane. No macroscopic tumour.



Figs. 3 and 4. (Case 3.) Massive diffuse density covering the right maxillary sinus, whose bone walls are entirely lacking. The destructive process also involves the lower and lateral part of the orbital margin as far as the zygomatico-frontal suture.

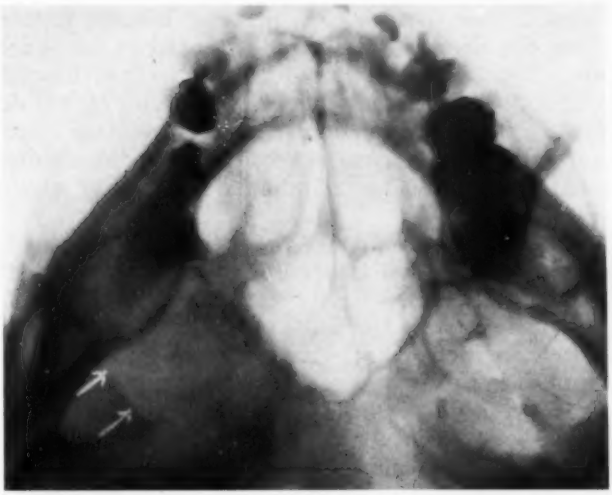


Fig. 5. (Case 3.) The destructive process has extended from the right maxillary sinus far into the ala magna. See the arrows.

The maxillary sinus is empty. The base of the orbit and the bone in the zygomatic region are entirely lacking. There is no destruction in the true sense of the word but possibly some kind of rarefying osteitis.»

Pathologico-anatomical examination: »Fibromatous tissue, partly relatively poor in nuclei and partly moderately rich in nuclei, of somewhat varying density. A number of small bone fragments in the tissue, of which some are evidently remains of the maxillary bone and show some lacunar resorption, whereas others appear to be newly formed. — Fibro-osteoma.»

When radiological examination of the paranasal sinuses has revealed a process with bone destruction in a maxillary sinus or the ethmoid air cell region, we have obviously hitherto suspected a *malignant* neoplasm. My three cases described in the foregoing, which were verified by pathologico-anatomical examination, nevertheless show that *benignant* processes can also exist, which owing to pronounced pressure atrophy can cause lesions resembling destruction. In the first case described it was thus a fibro-osteoma in one ethmoid air cell region (fig. 1). In this case the destruction of the bone not only involved the septa of the ethmoid bone but also the medial wall of the maxillary sinus and extended so far that an exposed dura was found at operation. In the other two cases, in which the process was localized to one maxillary sinus, the destructive factor was still more pronounced. In Case 2 (fig. 2) the arch-shaped outward dislocation of the lateral wall of the maxillary sinus nevertheless gave the definite impression that the sinus had been the site of an ex-

pansive process before the destructive factor became predominant. In the third case the destructive process extended as far as into the surrounding bone (figs. 3, 4 and 5). These three cases thus show that in affections of the maxillary sinuses and of the ethmoid air cells it can at times be impossible to make a differential diagnosis radiologically between a benign process and a malignant neoplasm. Moreover, the possibility of a fibro-osteoma should be borne in mind in making the differential diagnosis.

It is not possible to determine the nature of the process on the grounds of clinical symptoms. In the first case reported, in which the process was localized to the left nasal cavity and the patient had suffered from nasal obstruction for a long time, the extensive neoplasm could be seen on rhinoscopy. Since, however, the nature of the expansive process could not be determined in this way, a sample biopsy was taken and it was then possible to make the diagnosis of fibro-osteoma.

In the two other cases, when the process was localized to a maxillary sinus, material for biopsy could not be obtained without surgical intervention. In neither of these cases were there any rhinological symptoms. In one case the only subjective sympton was the swelling of one cheek, and in the other the depression of the region below one eye. In the first of these two cases, that of the 14-year-old boy, it is true that the patient was referred to the hospital with the diagnosis of cancer of the maxilla. Nevertheless the case-history with its relatively slow progress and the total absence of rhinological symptoms caused the possibility of a fibro-osteoma to be discussed *before* the roentgen examination. The radiological findings were, however, considered to indicate a malignant process and the patient was therefore given pre-operative roentgen therapy as a precaution.

In the third case there were also considerable difficulties in making a differential diagnosis, but the case-history of many years, the absence of rhinological symptoms despite the extremely marked bone destruction, the normal blood sedimentation rate and normal blood picture were considered to speak against the presence of a malignant neoplasm. The findings at operation seemed in the first place to indicate some form of slow, atrophying osteitis. In this case as well, the biopsy examination made a definite diagnosis possible and the tumour in the maxillary sinus was excised.

SUMMARY

Three cases of fibro-osteoma, verified by pathologico-anatomical examination, are described. The radiological picture, owing to extremely pronounced pressure atrophy, gave the impression of a malignant neoplasm accompanied by destruction of the bone. The knowledge of such conditions are of great importance from the differential diagnostic viewpoint.

ZUSAMMENFASSUNG

Es werden drei Fälle von durch pathologisch-anatomische Untersuchung bestätigtem Fibro-Osteom beschrieben. Auf Grund äusserst stark ausgesprochener Druckatrophie machte der Röntgenbefund den Eindruck einer bösartigen Neubildung mit Knochenzerstörung. In differentialdiagnostischer Hinsicht ist die Kenntnis dieser Dinge sehr bedeutungsvoll.

RÉSUMÉ

Description de trois cas de fibro-ostéomes, vérifiés par l'examen anatomo-pathologique. A cause d'une atrophie par compression extrèmement prononcée, l'image radiologique faisait penser à un néoplasme malin s'accompagnant de destruction de l'os. Au point de vue du diagnostic différentiel il est de grande importance de connaître ces cas.

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(CHIEF: PROFESSOR T. DALE, M. D.)

THE ABSORPTION OF MYELOTRAST (ABRODIL) FROM THE SPINAL CANAL[1]

by

Haakon Ødegaard.

ARNELL & LIDSTRÖM were the first to show that Abrodil could be used for myelography. It is, however, only during the past six years that myelography with Abrodil has become more and more commonly used for diagnosing herniated discs in the lumbar region (ARNELL, FELTSTRÖM, LINDBLOM, ANDOLF & ENROTH).

At the Roentgen Department of the University Hospital we now use 10 cc of a 20 per cent »Myelotrast» solution, which is the same chemical substance as Abrodil (*i. e.*, the sodium salt of mono-iodomethane-sulfonic acid). The solution is given as an intraspinal injection with the patient under spinal anesthesia.

The specific gravity of this solution is 1,130, whilst that of the cerebrospinal fluid is 1,006 to 1,008. In order to retain the contrast medium in the lumbar region and also in order to prevent it from spreading in cranial direction the patient should lie during the injection and subsequent examination in a sloping position with the head elevated. For this purpose we use a tilting table as described by T. KLASON. With the patient in lateral, oblique, and prone positions roentgenograms are taken under fluoroscopic control, horizontal rays being used. It takes approximately 5 to 6 minutes from the injection of the contrast medium until the final picture has been taken. A further ten minutes have to be calculated with until the last picture has been examined in the dark-room. There is a certain amount of disagreement as to how the patient should lie after the examination. FELTSTRÖM (1942) recommends that the patient should lie for two hours with his head slightly raised. ARNELL (1944) also recommends this procedure, whilst K. LINDBLOM in a later work claims that in order to avoid complications the upper part of the body should be elevated during the actual examination only.

[1] Submitted for publication, Oct. 26, 1948.

Fig. 1. Case 1.

A. Myelography with Myelotrast. Roentgenogram taken immediately after the injection.
B. 25 minutes after the injection. Note that considerable quantities of the contrast medium still remains.

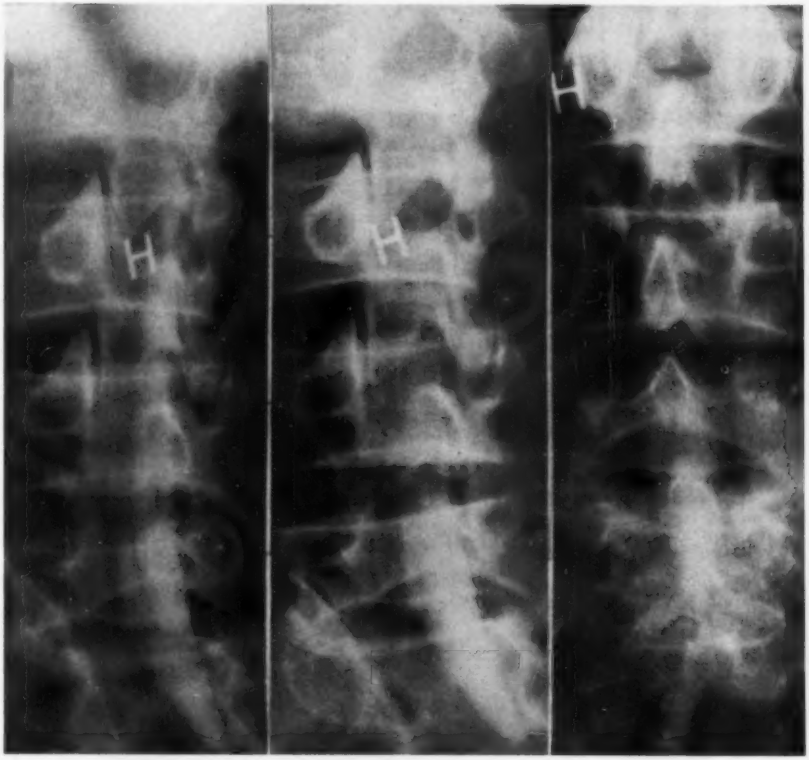
It is commonly accepted that complications, apart from those caused by the spinal anesthesia, are the result of the irritating effect of the Abrodil solution. As long, therefore, as any of the contrast medium is left in the spinal canal, it cannot be justified to let the patient lie completely flat, giving the hypertonic solution an opportunity of spreading in cranial direction to those parts of the spinal canal which have not been affected by the anesthesia. An important practical question, therefore, is: How quickly is the contrast medium absorbed.

Fig. 2. Case 2.

A. Myelography with Myelotrast, normal findings.
B. 55 minutes after the injection some contrast is still visible.

FELTSTRÖM claims that the contrast medium is quickly absorbed and will have disappeared after approximately half an hour. This corresponds with similar statements made by ARNELL & LIDSTRÖM. NORDENTOFT states that after 15 minutes only a small »torpedo-shaped» remnant of the contrast medium is left.

In order to judge the absorption of Myelotrast when this medium is used for myelography we have occasionally taken control roentgenograms some time after the conclusion of the examination, and whilst the patient still remains on the examining table with the head end elevated.



A B C

Fig. 3. Case 3.

A. Roentgenogram taken immediately after the injection.
B. 30 minutes after the injection. Considerable amounts of the contrast medium remain.
C. After 60 minutes only slight opacity left.

Case 1. Female, aged 22. Sciatic symptoms on the left side for six months. Neurological examination suggested a protrusion of the fourth intervertebral disc. Myelography with Myelotrast gave a negative result. The control roentgenogram taken 25 minutes after the injection of the contrast medium showed that there was still a considerable amount of the contrast medium left in the spinal canal (Fig. 1).

Case 2. Male, aged 44. Sciatica on the left side for a number of years. Neurological examination showed no sign of compression of nerve roots. Myelography gave no pathological findings. Retention roentgenogram after 55 minutes showed that there was still a little contrast medium left in the spinal canal (Fig. 2).

A B

Fig. 4. Case 4.

A. Myelography with Myelotrast showing compression of the fifth lumbar nerve root on the left side.

B. After 45 minutes only traces of the contrast visible.

Case 3. Male, aged 38. Sciatica on the left side for 3 to 4 years. Myelography revealed no pathological findings. Plenty of contrast medium was present after 30 minutes, and after 60 minutes some opacity was still visible (Fig. 3).

Case 4. Female, aged 46. Sciatica on the left side for approximately one year. Myelography revealed a protruded fourth disc with compression of nerve root on the left side (verified at operation). After 45 minutes a slight opacity remained (Fig. 4).

Our investigations have shown that the contrast medium is absorbed more slowly than we had believed. The fact that the contrast medium in some cases (as in case 4) disappears more rapidly than in others (case 3

may be explained by a more even distribution of the contrast medium in the former case. In order to prevent diffusion of the contrast medium into the thoracic part of the spinal canal we have made it a practice to keep the patient lying with the upper part of the body elevated for an hour after the conclusion of the examination.

SUMMARY

Retention roentgenograms have been taken following myelography with 10 cc of a 20 per cent »Myelotrast» solution (Abrodil). One has to calculate with the fact that it may take a little more than one hour before the contrast medium is completely absorbed. The patient should consequently lie with the upper part of the body elevated for approximately one hour and a half after the injection of the contrast medium.

ZUSAMMENFASSUNG

Nach Myelographie mit 10 cc 20 %-iger »Myelotrast»-Lösung (Abrodil) sind Retentionsröntgenbilder aufgenommen worden. Man muss mit dem Umstand rechnen, dass es etwas über eine Stunde dauern kann, ehe das Kontrastmittel vollständig absorbiert ist. Der Kranke muss also etwa anderthalb Stunden nach der Einspritzung von Kontrastmittel mit hochgelagertem Oberkörper liegen.

RÉSUMÉ

On a radiographié les résidus du produit de contraste après des myélographies avec 10 cc d'une solution de »Myélotraste» à 20 pour cent (Abrodil). Tenir compte du fait qu'il faut un peu plus d'une heure pour que la substance de contraste soit complètement résorbée. Aussi le malade doit-il rester couché, avec le haut du corps relevé, pendant une heure et demie après l'injection du produit opacifiant.

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INTRA-CAVITARY CONTACT ROENTGEN THERAPY OF MALIGNANT TUMOURS[1]

by

Dr. *D. den Hoed*

Contact roentgen therapy of the malignant tumours which was originally almost exclusively applied to easily accessible carcinomata has now become established and has in many cases replaced radium.

In the Rotterdam Radio-Therapeutic Institute hundreds of skin and lip cancers have been successfully treated with contact roentgen radiation. It will be evident that the indications for this treatment should be accurately given and that one should not forget that contact roentgen therapy is a comparatively superficial acting agent. Failures in the treatment of skin and lip carcinomata are extremely rare and when they do occur they may usually be attributed to faulty technique such as involuntary movement of the roentgen ray beam as a result of insufficient fixation of the applicator or the part of the body being treated and under estimation of the extent of the carcinoma.

Marginal recurrences or an apparent cure by the disappearance of the tumour from the surface and infiltration into the depth are then the result.

Besides these important services which the contact roentgen apparatus has rendered us in the course of years, owing to which the available quantity of radium could be employed for more important lesions, this apparatus may be used in even more ways which in principle are of much greater significance, namely for intra-cavitary radiation.

In many naturally accessible cavities of the body, but also in cavities which are artificially made accessible, radiation may be applied by means of the narrow contact roentgen tube.

I have already worked out many varieties, and although the number of patients treated in this way in various groups, is still too small and has

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often not been observed long enough to be classified statistically, I consider it important enough to describe the methods and to illustrate them with examples. It would not be difficult to give a considerably larger number of case reports in all the fields to be discussed of patients who were successfully treated in this manner. However, the examples given in the following lines will be sufficient to indicate the possibilities of these methods.

Many *intra-oral cases* lend themselves very well to contact radiation.

Case Report 16572. In the middle of 1943 a 44-year-old man was treated for a small histologically proved carcinoma situated in the centre of the tongue. A single treatment of 4000 r was given and though the patient experienced a violent and prolonged reaction, the tumour is now entirely cured. A year later this patient developed a small cancerous growth on the processus alveolaris of the left upper jaw. A diathermic biopsy confirmed the diagnosis and removed the greater part of the growth. The base of the lesion was then treated by contact radiotherapy on two consecutive days to a total dose of 4000 r and up to the present time there is no evidence of a recurrence.

So we can definitely state that in a patient a tongue cancer and a carcinoma of the processus alveolaris were cured by contact-Roentgen-radiation.

Case Report 16607. In July 1945 a 64-year-old man came to us with a carcinoma of the left buccal mucous membrane of 3 cm diameter with enlarged left submandibular glands (metastases). The lesion and the enlarged submandibular glands were treated with high voltage therapy to a total dose of 2000 r in four days. Contact roentgen therapy was then applied through two small fields on the oral surface of the buccal growth including a rather wide margin of normal tissue and a dose of 3400 r administered to each field in three days. Though the local radiation reaction was severe this subsided after a few months and the patient now is in good health with no sign of a recurrence.

Although roentgen contact radiation was not applied exclusively the success is in a great measure due to this treatment of the tumour.

We can now state that a case of cancer of the buccal mucous membrane with submandibular glandular metastases has been cured by external treatment with high voltage-therapy and contact roentgen radiation of the buccal mucous membrane.

Case Report 16595. In July 1945 a 65-year-old man was treated for a cancer of the floor of the mouth of 2 × 1 cm and extending 1 cm in depth. The patient was treated with contact roentgen therapy and in the course of 17 days got 16 000 r in the mouth through two fields. During the treatment the tumour disappeared and it has not recurred up to this moment. A later also histologically discovered submandibular gland metastasis was made to disappear by means of deep roentgen therapy and radium puncture. The patient has remained well up to present time.

Contact roentgen radiation with narrow applicators is also suitable for the treatment of smaller carcinomata in the *vestibulum nasi.*

Case Report 13297. A 45-year-old man who had noticed an easily bleeding little tumour in the left vestibulum nasi for several months was given 2400 r of contact roentgen therapy in a single treatment on the 4th June 1943. The tumour disappeared one month later and has not recurred.

Sometimes *cancer of the pharynx* may easily be treated intra-orally.

Case Report 15199. In the summer of 1944 a 72-year-old man came to me to be treated for an extensive carcinoma of the front palatine arch which extended from the uvula far into the tonsil area. The dimensions were 6 × 3 cm. There was comparatively little deep infiltration. A small submandibular tumour was perceptible which was considered to be a metastasis. The pharyngeal tumour was treated with contact roentgen therapy through two fields over a period of three weeks. The largest field received 6000 r; the smallest deep down in the tonsil area 4300 r. The gland was treated with deep roentgen rays (3200 r). The tumours disappeared and the patient has been completely cured up to this moment.

Tumours in the *hypopharynx* and the *entrance to the esophagus* are in special cases suitable for intra-oral contact radiotherapy.

Case Report 86. In November 1942 a 44-year-old man came to consult me, in whom the laryngologist had found a carcinoma in the entrance to the larynx. The growth was complicated by a roentgen ulcer on the right side of the neck which was the result of Roentgen treatment of tuberculous lymph glands in the early days of roentgen therapy (1915). This roentgen ulcer was found overlying the larynx in the centre of an atrophic area which covered a considerable portion of the skin of the right half of the neck. The underlying tissue was sclerotic. The post cricoid growth formed a rough ulcerating mass occupying the entire ligamentum aryepiglotticum and covering the greater part of the aditus which because of the above mentioned sclerosis, was asymmetrical in position. The sinus piriformis too was entirely covered by the tumour-mass which even extended to the sidewall of the pharynx. On the left side of the neck near the cartilago thyreoidea there was a fixed infiltration of $1^1/_2$ cm diameter adherent to the vascular bundle, and believed to be a metastatic gland. Though operation might be considered as a treatment of extrinsic laryngeal carcinoma (which many experts reject for this type of lesion) the great extension, the fixed gland-metastasis, and especially the injury to the tissues caused by the earlier radiation were insurmountable obstacles to surgery in this case. Consequently roentgen treatment was the only therapy to be considered but we believed this to be extremely hazardous due to the previous radiation injury and at first refused to undertake the treatment. At the urgent request of the laryngologist, the patient was admitted to our clinic in a suffocating condition which required an immediate emergency tracheotomy. Our task was now to apply a method of treatment which would yield a reasonable chance of cure without further endangering the already seriously injured tissue. The presence of the very extensive local growth with a glandular metastasis of a rather radioresistant histological type (cornifying squamous cell carcinoma) made it important nevertheless to apply the maximum tolerable dose if the patient was to be given any chance of cure or even prolonged palliation. A right lateral field could not be used because of the old radiation ulcer on this side. Fortunately the growth and glandular metastasis were on the left, the least damaged side of the neck, which made it possible for us to deliver a large dose of 6400 r (measured in air) through a 10 × 12 cm left external field in a period of one month.

In the meantime special tube-shaped applicators were being manufactured that would enable us to apply intra-cavitary contact roentgen therapy. The tumour-focal distance was 14 cm. The patient was narcotized with evipan-sodium and placed in a Trendelenburg position to prevent aspiration of blood and mucus. A tube-shaped applicator with a 2 cm opening was then accurately focussed on the growth and 1000 r (measured in air) administered. The tongue was drawn outward as far as possible in order to allow the patient to breath more freely during this rather prolonged treatment time (15 minutes). The treatment was tolerated very well, and soon a fibrinous coating was observed on the

tumour and its immediate surroundings. The tumour and internal reaction had disappeared by January 20th 1943 but the ligamentum aryepiglotticum sin. was still edematous. By the end of January a marked epidermolysis appeared on the left side of the neck as a result of the external radiation and the roentgen ulcer on the right side became somewhat more active. In spite of all this the patient was well enough to be discharged from the hospital on January 26th 1943 without respiratory or swallowing difficulties. The tracheal canula was left in place as an additional safety factor and the opening plugged with a small cork. The voice was still husky, but in the course of the next few weeks it recovered fairly well. The patient's general condition greatly improved, his weight increased from 60 to 70 kg, and he was able to resume a great part of his work. This favourable condition has continued up to the present time although the voice became huskier again later on, the right arytenoid being somewhat swollen. In this case it is obviously impossible to estimate the part which internal irradiation had in the cure but it is my firm conviction, based on further experience with this method, that it must have been important. This treatment with the help of local anaesthesia, by anaesthetizing the mucous membrane for example with sol. cocaini of 20 per cent, is well-tolerated by most patients.

Case Report 19839. In the summer of 1946 a 19-year-old girl was admitted for treatment of a large sarcoma of the right arytenoid. The tumour was so large that the patient had considerable difficulty in swallowing, breathing was greatly impeded, and the voice had weakened very much.

Since oral feeding was out of the question, a gastrotomy had to be performed. The patient was then given deep roentgen therapy through two 8 × 8 cm lateral fields at 40 cm skin-target distance to a total dose of 3000 r per field in three weeks. There was a marked epidermolysis and mucositis following the treatment and though the tumour decreased considerably in size it began to increase again after 6 weeks. After some weeks' observation the tumour grew distinctly and as the tissues of the patient could not stand a second Roentgen-series on external fields, we decided to give intra-oral contact Roentgen therapy. The field size was 2 × 2½ cm. In the course of one week the tumour received 5 000 r. A strong fibrinous coating of the sinus piriformis and surrounding tissues appeared, the tumour gradually subsided, and the patient steadily improved. Only a fibrous scar on the lig. aryepiglotticum remained. All the functions of the larynx and epiglottis were completely restored so that the gastrostomy was closed soon afterwards.[1]

The roentgen contact apparatus will also very probably find a most important application in the case of *tumours of the larynx.* Small cancers of the vocal chords without deep infiltration may be cured by introducing special applicators in the larynx through which the tumour may be irradiated.

Case Report 21623. In the middle of May 1947 a 61-year-old man was admitted for hoarseness, which on examination turned out to be caused by a carcinoma of the anterior part of the left vocal chord reaching to the commissura anterior. The tumour was treated with intra-laryngeal contact roentgen therapy to a total dose of 6500 r in three weeks. The treatment was completed with a small dose of roentgen rays through 2 external fields of 5 cm diameter centered over the larynx. The left lateral field received 1200 r and the right lateral field 800 r over a period of 7 days. This supplementary treatment alone would have been quite inadequate to heal the tumour so that the cure, with complete preservation of the voice, may with certainty be attributed to the intra-laryngeal treatment.

[1] Some months ago a recurrence was found for which she is now under treatment.

Case Report 21619. A 54-year-old man was admitted in the middle of May 1947 for papillomatosis of the vocal chords. The whole larynx appeared to be filled with an extensive papillomatous growth entirely covering both vocal chords and markedly narrowing the front half of the larynx. Contact roentgen therapy was applied intralaryngeally on May 15th and 16th with a dose of 1000 r each day. Following this treatment, the papillomata showed a marked regression in size. On June 27th other large remnants of papillomata were given a similar treatment. In early 1948 all that remained of the tumour was a single small inactive remnant in the commissura anterior which was not causing any symptoms.

Case Report 17391. A 40-year-old woman, who had been hoarse for years and from whose vocal chords small »polypi» had repeatedly been removed, had gradually noted increasing hoarseness during the last few years and was sometimes short of breath. On examination a papillomatous 3 mm tumour was found on the right vocal chord and the left vocal chord was infiltrated for the greater part to within the commissura anterior.

A laryngotomy by the laryngologist showed a carcinoma and if surgically operated upon, the entire left vocal chord and part of the right one would have to be removed. In view of the bad functional result which might be expected from such a surgical procedure, we decided to treat the patient with contact roentgen radiation. By 3 small fields the papillomatous tumour was treated via the laryngotomy with 3000 r, the left vocal chord with 4500 r, the right anterior commissure getting 4000 r. After this treatment durante operatione, which took only a few minutes, the laryngotomy was closed. The patient has been well since October 1945 and although the voice has remained somewhat veiled she speaks quite distinctly.

Contact roentgen apparatus is also proving to be of value in the treatment of both *papilloma and carcinoma of the bladder.*

Case Report 20122. In the autumn of 1946 a 46-year-old man came to us for treatment, who in the course of the last seventeen years had constantly been developing more and more extensive and larger papillomata in the bladder. He had been treated repeatedly with endoscopical electro-coagulation and a few times through suprapubic cystotomy. The tumours nevertheless continued to recur. The surgeon was unable to coagulate these tumours through the urethra. Moreover the findings suggested malignant degeneration, so that it was resolved to perform suprapubic cystotomy and to treat the tumours with contact roentgen therapy. Depending on their size, the tumours were treated with 10000 to 15000 r, so that on calculation about 3000 r was applied to the base of the tumours. A few small papillomata were coagulated separately. The patient was discharged as cured after about 3 weeks, and so far he has not had a recurrence.

Case Report 18222. A 59-year-old man, who had been suffering from severe painful hematuria for about a year, was found to have a carcinoma in the trigonum vesicae one inch in diameter. The patient was admitted to the hospital early in 1946. The tumour was exposed through a suprapubic cystotomy and 20000 r delivered by contact roentgen therapy. The cystotomy was closed immediately following this treatment. Though this large surface dose of 20000 r corresponded to only 1600 r at the base of the tumour, the tumour nevertheless showed a marked regression, and only a small remnant remained. In May 1946 the above procedure was repeated and 6000 r delivered to this residual tumour which corresponded to 3000 r at its base. The patient made a complete recovery but later on developed small papillomata in the surrounding tissue. These were removed by coagulation.

Another field in which contact roentgen therapy is finding use is in the treatment of *rectal carcinoma*. Since surgical resection of rectal carcinoma is often difficult and dangerous and nearly always followed by serious functional impairment, this more conservative method of treatment may be preferable in certain cases.

Case Report 14801. On May 30th 1944 a 74-year-old man with a history of bloody stools for 6 months came to us for treatment of a portio-shaped tumour with a central crater situated on the anterior wall of the rectum 6 cm from the anus. The dimensions of the tumour were 6 cm by 4 cm. The thickness was estimated at $1^1/_2$ to 2 cm. In the middle of 1944 the patient was treated with roentgen contact therapy 7500 r being administered weekly on various fields. A total of 21000 r to 30000 r per field was applied. In the course of two weeks the patient also received high voltage therapy through 4 external fields. A dose of 1200 r was given to each field. Gradually the tumour subsided and the ulcer healed so that the patient had no complaints for a long time. There remained a scar with a somewhat thick centre, solid on the touch. Recovery was never complete but in view of the good general condition and the absence of local complaints, no further treatment seemed advisable at this time. After two years however it became apparent that the tumour was growing again, so that in the summer of 1946 we decided to give the patient a second treatment.

The lesion was treated through four fields with a daily dose of 1000 r to each field for twelve days.

At this moment the patient's general state of health is good, he has practically no complaints except for slight blood in his stools. In the rectum there is a moderate stricture, part of which consists in a fixed and slightly ulcerating area which does not appear to represent tumour.

Case Report 16940. In the summer of 1945 a 59-year-old man came to us with a history of rectal bleeding. On examination a big, firm, somewhat fixed, tumour with thick raised edges and a central ulcer was found beginning 4 cm above the anus. The diameter of the tumour was 6 cm. The tumour was fixed to the sacrum by perirectal infiltration on the left side. It appeared to be inoperable and in addition the patient refused any surgical intervention. For this reason it was decided to treat the patient with contact roentgen radiation alone. In 3 weeks approximately 11000 r was applied on 5 fields. The tumour decreased considerably in size, but after 2 months we still found a thick tumour wall at the upper edge. This area was attacked once more using 3 fields each an inch in diameter. 6000 r was delivered to each field in one week. Patient's condition steadily improved although he complained of some tenesmi. An ulcer remained perceptible, which later on proved to represent a strong radiation reaction. Gradually the local condition improved but at the beginning of 1946 carcinoma was still found in some biopsies. In a third treatment 10000 r was administered on 3 fields in one week. Following this last treatment the patient has had practically no complaints, although he still occasionally passes some bloody mucus. His general condition has steadily improved and he has gained in weight (from 77 to 81 kg). Locally an ulcer with somewhat firm but chiefly edematous edges is still demonstrable; it may represent a radiation ulcer.

Case Report 20142. In the beginning of November 1946 a 62-year-old man came to us with a complaint of rectal bleeding. He was found to have an adeno-carcinoma 4 cm in diameter and 2 cm thick on the anterior wall of the rectum.

The patient was treated with roentgen contact radiation, 16 000 r being administered on 4 fields in 9 days. The patient experienced a rather long, painful reaction, but appeared to be completely cured a year later.

Undoubtedly this method will be of permanent use in certain cases of cancer of the rectum. From the quoted reports it already appears that temporary improvements, which appear to represent clinical cures, have been obtained. Moreover one should not forget that the technique of this treatment has yet to be perfected and standardized. In the future, when the plan of treatment will have been better established, the accuracy of the method will be enhanced. The indications will be increased on the strength of experience and this will make it possible to select the correct treatment and technique for each case as local or general peculiarities may require.

Certain cases of *carcinoma of the vulva and vagina* may also be benefited by contact roentgen therapy.

Case Report 11100. A 62-year-old female patient showed an easily bleeding raised erythematous lesion in the commissura posterior of the vulva with in some places a distinct tumour-formation and leucoplasia of the surrounding mucous membrane of the vagina. The carcinoma had a diameter of 7 cm. The patient was treated with about 2200 to 3000 r per field in one week with a skin-focus distance of 2 to 6 cm. Fields of 2—6 cm in diameter were treated; the smaller ones at a short distance, especially for the shallow growths at the margins. The tumour gradually disappeared, and the patient has been well for more than 5 years.

Extensive *cancers of the portio uteri* may be successfully reduced in size by means of roentgen contact radiation with little or no effect on the rectal mucous membrane. This treatment may have great advantages especially for very voluminous tumours which increase the danger of injury to the rectum by radium owing to the difficulty of fixing the radium at an ample distance from the rectal wall.

Case Report 19490 describes a 43-year-old woman who had been complaining of bleeding and discharge for 4 months. On examination in August 1946 a cauliflower-shaped carcinoma of the cervix 8 cm in diameter with a central, deep, infected crater and firm parametria was discovered. On arrival in the clinic she had a temperature of between 38° and 40°, and she had lost so much blood that her hemoglobin was only 35 per cent. In spite of her obvious poor prognosis, the patient was treated with roentgen rays through external fields and with roentgen contact irradiation (1000 to 5000 r per day) to a total of 20000 r on the surface of the large tumour. This method was chosen because the tumour filled the entire vagina in such a way that radium could not be applied without serious danger to the rectum. The bleeding continued for some time and after a few weeks the blood hemoglobin was only 25 per cent. Blood transfusions were given. Meanwhile the tumour decreased considerably in size and the hemorrhages diminished so that the normal radium treatment could be carried out without any difficulty. In the middle of October 1946 the patient was discharged from the hospital. In December 1946 a second roentgen-series through external portals was administered. In the beginning of 1948 her local and

general condition was good and her hemoglobin had returned to normal. She never complained of proctitis.

Although the period of observation has been too short to evaluate the ultimate result, this case report is a distinct indication of the possibility of reducing abnormally big tumours by means of contact radiation to such an extent that the normal radium treatment can be carried out without difficulty or danger to the rectum.

From these very divergent reports it appears that contact roentgen therapy can be applied in a great many fields for tumours which are within more or less easy reach along various natural or artificial openings in the body.

It seems probable that in the future even more uses will be found for intra-cavitary contact roentgen therapy. This method may for instance be considered in certain cases of carcinoma of the cardia, which have been surgically exposed. Glandular metastases in the neck, axilla, and groin, which are difficult to operate, may be attacked in this way in order to spare the skin and the soft parts. This method has already been tried, in treating the wound cavities of brain tumours which had not been radically removed, and without being too optimistic, the results seem to indicate that some patients may be benefited by this method.

The mentioning of these few future possibilities does not nearly exhaust all the sources of improving the therapy of cancer by this method. The greatest useful effect may be expected from the close co-operation of radiologists and specialists in other branches, who each in their own spheres can help to extend the indications and by their technical skill to create the conditions for intra-cavitary treatment. It is evident that this method cannot be applied to all tumours in the discussed locations, and that the patients will only be treated in this manner when other methods seem to be less successful or too dangerous.

The indications for this treatment will have to be established with the utmost care, with a thorough knowledge of the possibilities of the method, and of the chances which other methods of treatment offer.

A warning against using this method indiscriminately is very necessary, in order to prevent it from being discredited by uncritical application.

The only purpose of this communication, is to make it clear that intra-cavitary roentgen contact therapy may be used for many purposes and may sometimes even produce a successful result where other methods offer little or no chance or have failed already.

SUMMARY

A description is given of intra-cavitary contact roentgen therapy with the help of case reports of patients suffering from tumours in the mouth, nose, pharynx, hypopharynx, larynx, bladder, rectum, vulva, vagina and uterus. Some other possibilities are mentioned, and a warning is given against uncritical application of this new method.

ZUSAMMENFASSUNG

An Hand von Berichten über Fälle von Tumoren in Mundhöhle, Nase, Rachen, Hypopharynx, Kehlkopf, Blase, Mastdarm, Vulva, Scheide und Gebärmutter wird die intrakavitäre Kontaktröntgenbehandlung beschrieben. Gewisse andere Möglichkeiten werden erwähnt, und vor unkritischer Verwendung dieser neuen Methode wird gewarnt.

RÉSUMÉ

Description de la radiothérapie intracavitaire de contact, avec, à l'appui, les observations de malades atteints de tumeurs de la bouche, du nez, du pharynx, de l'hypopharynx, du larynx, de la vessie, du rectum, de la vulve, du vagin et de l'utérus. L'auteur mentionne quelques autres possibilités et met en garde contre l'application sans esprit critique de cette nouvelle méthode.

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PRE-OPERATIVELY DIAGNOSED ILEUS DUE TO GALL STONE[1]

by

Egon Norinder and *Roland Gay*

The syndromic picture of intestinal obstruction due to gall stone has often been described and the symptoms are well known, but the scantiness of reports on the pre-operative establishment of this lesion seems to be such as to warrant a contribution to its roentgenological diagnosis.

The escape of a stone from the gall bladder via the duodenal papilla and its re-appearance in the feces after a biliary colic, is not infrequent. The passage via the papilla of stones large enough secondarily to cause occlusive ileus is a rare phenomenon.

In the mechanism of gall-stone-ileus a fistulous connection between the walls of the gall ducts and the gastro-intestinal canal is generally expected. ROTH, SCHROEDER and SCHLOTH, who found only 43 internal gall fistulas in 10,866 post mortem examinations, however, uphold the view that such fistulous anastomosis is rare. This view is also supported by a publication by BOCHHUBER, DEEB and TAYLOR, who found only 14 cases (0.88 p.c.) of internal biliary fistulas in a material comprising 1,699 cases suffering from acute biliary tract diseases. JUDD and BURDEN made a collection of 153 cases of gall fistulas; 6 of these fistulas anastomosed with the stomach, 117 with the duodenum, 4 with the duodenum and colon, and 26 with the colon only. In 148 cases the fistula proceeded from the gall bladder; in one case, from the common bile duct; and in 4 cases, from the cystic duct.

The factors responsible for fistulas are to be sought in the gall-stone in combination with inflammatory conditions. Complications appearing in association with gastro-duodenal ulcers, however, play but a subsidiary rôle in the genesis of the fistula. In rare cases gall fistulas are encountered in association with cancer of the stomach or gall bladder.

Before the introduction of roentgen diagnostics it was almost impossible for the clinician to establish an internal gall fistula, this being reserved for the pathologist, and to a very limited extent, for the surgeon.

[1] Submitted for publication, Oct. 15, 1948.

At cholecysto-enterostomy in 1923 CASE observed a contrast filling of the gall ducts. Later MALLET-GUY and BEAUPÈRE showed the presence of air in the bile ducts at cholecysto-gastrostomy. These observations form the fundaments of the roentgen diagnosis of internal fistulas. The basic factor of the diagnosis is the presence of air, contrast medium or both in the biliary ducts. The method has since been elaborated by inter alia JUDD and BURDEN, HABBE and SMITH, HAENISCH, KANTOR and JAFFIN, ÖHNELL and LINDBLOM, GRÅBERGER. Already in 1935 LÖNNERBLAD had collected 36 cases of rtgn. diagn. internal biliary fistulas. The material is remarkable inasmuch as one third of the fistulas had been caused by ulcerous gastro-duodenal perforations.

The demonstration of air or radiopaque medium in the gall ducts is not proof of an internal fistula. As early as 1912 GOLDMANN showed that the intestinal content ascends into the gall bladder without any internal fistulous connection. At cholecystostomy he exhibited in the external fistulous bile, charcoal particles previously administered per os. In chronic pancreatitis, ÅKERLUND noticed an opaque filling of the gall ducts via the papilla. PETRÉN stresses the difficulties which are encountered in the differential diagnostical establishment of gallstone ileus and which are liable to arise on resection of the papilla Vateri, on the formation of diverticular connections in association with pancreatitis, after the passage of large stones to the duodenum, and in the presence of gas-forming bacteria in the bile ducts, *e. g.* in connection with cholangitis (cf. also BERG and BAASTRUP).

The syndrome of gall stone ileus is hard to judge. The history and objective clinical findings are at most sufficient to establish a probable diagnosis (cf. KAIJSER). In most of these obscure abdominal cases the diagnosis is possible only with the aid of careful rtgn. examinations. Such examinations should be performed without delay, and in this respect PETRÉN's advice is worthy of mention; he says: the quicker the diagnosis, the earlier the operation, the better the prognosis.

In existing intestinal obstruction the radiologically visualized presence of air in the gall ducts provides a strong support for the diagnosis »gall stone ileus». PETRÉN contends that an internal gall fistula large enough to permit the passage of a gall stone capable of producing ileus, ought to be roentgenologically recognizable, but the diagnosis will however not be quite clear until the stone can be visualized direct in the intestine. Its presence is reflected in the form of a radiopaque calculus in the most distal part of the widened intestine. It is however a fact that only a limited percentage of gall stones are radiopaque. The number of preoperatively diagnosed cases of gall-stone ileus including those of the present paper, amounts to 45. In 11 of these cases the diagnosis was established with the support of radiopaque stones. To demonstrate radiolucent stones without the application of pos. contrast media is however very difficult, and will be successful only under very favourable conditions. In 1942, NØRGAARD described two such cases in which the stone could be discerned in the form

of very rarefied, hardly discernible filling defect in the gas of the distended small intestine.

In analysing ileus cases, a contrast meal in only small quantities is useful (cf. LAURELL). The method is valuable inter alia in the diagnosis of gall-stone ileus. The risks expressed from certain quarters against this method, seem to be exaggerated. One argument brought forward against the application of the method is that contrast medium might deteriorate the ileus condition by the obstruction of a minimal but nevertheless existent passage. The small quantities of contrast medium used in these cases will however surely be diluted by the increased amount of fluid which relatively rapidly arises proximally to an obstruction in the obturated intestine. The existence of a stone in the small intestine causing occlusive obstruction will be visualized by a curvature in the pos. contrast medium at the site of the stone. If the obturation is only partial and permits part of the contrast medium to pass, a more or less annular contrast defect will be visible.

The use of contrast medium in association with the radiological examination has many advantages. It renders the visualization of a stone possible, or if the stone is radiolucent, the site of intestinal obstruction. This is of great value especially for the surgeon. A contrast meal facilitates also the establishment of the diagnosis ileus, especially in those cases not exhibiting the classical signs in the form of gas or fluid-filled intestines with horizontal levels. But the use of a test meal examination also has its limits. It is most suitable for more proximally located obstructions where a diagnosis is often quickly establishable. For more distally located obstructions the method is less advisable, because it may delay the operation and thereby deteriorate the prognosis. There is nothing to prevent the interruption of the radiological examination at an early stage if clear ileus signs appear and the condition indicates immediate operation.

In an internal gall fistula it is not always possible to visualize gas in the bile ducts. In pronounced ileus with distended gassy intestinal loops, the latter may cover the entire region of the bile ducts, with the result that the gas in the bile ducts will so to say be outshadowed by intestinal gas. This is especially the case when the gas in the bile ducts is but scanty. This may be the case with a fistula anastomosing the gastro-intestinal canal and a sclerotic gall bladder, in which the cystic duct is obliterated and does not permit the entrance of the gas into the bile ducts. In the case of a gall fistula with all its rtgn. characteristics, the ileus condition need not necessarily be due to gall stone. The escaping calculi may be so small as to pass the intestinal duct without causing obturation. In such cases the causal factors of the ileus ought to be sought in some other mechanism, foreign bodies, tumours, adhesions etc. In the literature, inter alia by

GUILLEMIN, gall calculi are said to be the cause in about 3 per cent of the cases of ileus.

The syndrome of ileus due to stone is difficult to depict briefly. Besides this, it is very versatile. According to TENGVALL the typical case is characterized by the sudden appearance of subileus or ileus conditions with remissions varying from hours to days in an intermediate period completely free of symptoms. PETRÉN points out that similar symptoms are usual also in cases of ileus due to other reasons, but that they are more marked in gall-stone ileus. This opinion is contradicted by WAKEFIELD, VICKENS and WALTERS, who contend that gall stone ileus per se exhibits no typical feature and that a pos. gall-stone history is of little value.

A question that has absorbed much interest is the time at which the gall stone leaves the bile ducts to escape through the intestine. In PETRÉN's analysis we seldom find anamnestic data of such a breaking away of the stone. KEHR likewise believes the passage of the stone to be symptomless.

The mechanism of the obturation and the remissions have been discussed lively in the literature. LEICHTENSTERN and also SÄFWENBERG ascribe the cause to purely mechanical factors, *i. e.* disproportion between the size of the stone and intestinal lumen. CASTNER and KAREWSKI blame the mechanical irritation of the intestinal wall by the stone, which is in turn believed to elicit a reflectory cramp in the intestinal musculature. KÖRTE advocates a similar spastic theory, but believes that the spasm is elicited chemically by the resorption of active substances from a stagnant intestinal content. WALLDÉN underlines the importance of a local inflammatory reaction to a mechanical lesion produced by friction of the stone against the intestinal wall.

The prognosis of ileus due to gall-stone has been depicted as very unfavourable. This is probably due to the diagnostical difficulties formerly encountered. Successive improvements have been made hand in hand with the development of roentgen-diagnostics. Of the 24 cases collected by WALLDÉN, 10 had terminated with exitus.

In the treatment of ileus, laparotomy with enterotomy is the normal method. DULIN and PETERSON (1939) recommend the destruction of the stone in situ. The method must be considered hazardous and the results obtained are not very encouraging. KAPEL laparotomizes under spinal anesthesia and squeezes the stone gently down into the colon where it is left to escape spontaneously. Recently he published two successful cases treated in this manner. Judging by general surgical experience this method is of but limited value. It is often impossible to force the stone from its impaction in the small intestine, mostly on account of the existent spasm. SÄFWENBERG showed experimentally that only in 50 per cent of a number of corpses was it possible to squeeze a phantom gall stone with max. and min. diameters of 3.7 and 2.6 cm. respectively, through the small intestine.

Reports of pre-operatively diagnosed gall stone ileus are scanty. The number of, in the disposable literature, hitherto published cases is about 40: HELLMER 4 cases (1930 and 1939), KAIJSER 1 (1934), SCHÉLE 1 (1935), SÄFWENBERG 2 (1936), GREGERSEN 2 (1938), PETRÉN 7 (1939—40), NØRGAARD 3 (1942), WALLDÉN 2 (1942), MELGAARD 1 (1943), LAUTROP 1 (1944), KAPEL 1 (1947) among others.

In our material there was a case with air in the bile ducts without any internal fistulous connection. It was a woman of 69 yr., who had perdiodically had attacks of cholecystitis.

In Fig. 1 you can see that the gall bladder (1.) fills normally by perorally administered contrast media and gets empty after egg-meal, showing free passage in the cystic duct. In the gall bladder there are some stones. In the hepatic ducts (2.) and in the distended common bile duct (3.) there is presence of air. A number of gall stones are lying in the common bile duct. The air has obviously entered through the sphincter Oddi.

Fig. 1. Demonstration of air in the bile ducts (see description in the text).

A review of five cases will now be given:

Case 1. J. 3492/43, Surg. I.S.S., N.K.A.

75-yr.-old woman hospitalized 17th Nov. to 6th Dec. 1943 for: Ileus obturationis. Since 1939, sudden acute diffuse abdominal pains, sometimes in association with vomiting. Constipation. No fever, no icterus. Fell acutely ill 15th Nov. with severe abdominal pains, especially in lower part of stomach. Total retention of feces. Vomited repeatedly. From status: nauseate, dehydrated, temp. 37.7°. Perpetual arrhythmia. B.P. 170/100. Abdomen slightly distended, soft, tender in lower part, no palpable swellings. Blood: Hb. 74 p.c., red cells 4.6 mill., white cells, 14,000. Urine: 0 alb. Numerous red cells in sed., no bact. N.P.N. 45 mg/100 c.c. Diastasis 8. Wr. neg.

Rtgn.-examination: Plane radiogram revealed no gassy intestinal loops or fluid levels suggestive of ileus. No signs of fluid in stomach.

Contrast meal (Fig. 2 a and b) showed that the radiopaque medium was present in a 1 cm. wide tract extending from the duodenal bulb

Fig. 2 a. (Case 1.) See description the text.

to a small gall bladder after which it filled the cystic, hepatic and intrahepatic duct as well as the common bile duct down to the papilla. The small intestine was distended and filled with fluid. The passage of the contrast medium finally terminated up in a loop in the small intestine in the small pelvis in which a typical curvature indicative of a calculus was observed (arrows, fig. 2 a).

Diagnosis: Gall-stone ileus plus fistula.

Operation (18th Nov.): Laparotomy — enterotomy — removal of gall stone. Small medial incision, small intestine lifted and gall stone palpated. Stone removed through a small longitudinal incision, sutured in transverse direction with running sutures. Calculus consisted of walnut-sized pigment-cholesterin stone. Intestine distended orally to obstruction. Post-operative course, good. Pat. released as healed.

Fig. 2 b. (Case 1.) Special picture, showing the gall ducts and the fistula between the bulb and the gall-bladder.

Case 2. J. 3510/45 Surg. I.S.S., A.G.B.

77-yr.-old woman, hospitalized 16th Nov.—9th Jan. for: Gall-stone ileus. Fistula cholecysto-duodenalis.

Since 1923 she had periodically had attacks of pains in the upper part of the abdomen, radiating to arm pits. On 26th May, 1941 attacks of abdominal pains, nausea and vomiting. No fever, no icterus, urine not discoloured. Rtgn. exam. (see below). Released symptomless after a few days. Afterwards, new similar attacks annually interpreted as biliary colic. Towards end of Oct. 1945, a similar heavy attack that lasted 20 minutes. Since then completely symptomless.

On 13th Nov. 1945, onset of severe pains in lower part of abdomen in association with repeated vomiting. Expelled stomach contents, dark, bile-coloured and gradually became evil-smelling. Complete retention of feces and gas. Admitted 16th Nov. From status: nauseated, dehydrated, moderately cyanotic and dyspnoeic. Temp. 37.7. Heart: 0., B.P. 185/100. Lungs: normal. Abdomen swollen, tympanitic, very tender with muscular defence over left quadrant, where a diffuse resistance was suspected. Per rectum: 0. White cells, 17,000. N.P.N., 56 mg/c.c. Urine: 0 alb.

At the *rtgn.-examination*, 1941, the perorally administered contrast media did not fill the gall bladder, but at its site a plum-sized rarefaction bordered by a calciferous zone, was observed. The finding was interpreted either as a solitary bile calculus or as a calcification in the gall bladder wall.

Rtgn.-examination (16th Nov. 1945): Fig. 3. Plane radiograph showed in central and left part of abdomen two dilated and gassy small-intestinal loops. Adjoining the caudal loop and in the left part of the abd. there was a plum-sized annular shadow reminiscent of a gall stone (arrows). No air was manifest in the bile ducts. The colon was filled without obstruction and diverticula were observable.

Operation (16th Nov.): Laparotomy — jejunotomy — removal of calculus. Medial incision at umbilicus. Somewhat increased amount of free fluid in abd. Op. revealed a fibrinous-coated loop of the small intestine. In the aboral portion of the loop there was impacted a calculus that could not be milked down further. The intestine was opened and the stone removed, sutured in three layers. Discharged as healed on 9th Sept. 1945.

Case 3. J. 3745/46 Surg. II S.S., L.H.A.T.J.

A 63-yr.-old woman, hospitalized 8th Oct.—30th Oct. 1946 for: Ileus (gall stone). Had gall-stone trouble since 1935. Nursed in 1942 for cholecystitis during which rtgn. showed no filling of gall bladder.

Fell acutely ill on 6th Oct. with nausea and vomiting. On 8th Oct. vomiting became more severe. Expelled stomach contents were yellowish-green and ill-smelling. Complete retention of feces and gas. Abd. swole more and more and pains became more intense. From status: no malaise, temp., 37.2. Heart and lungs: 0. B.P. 140/70. Abd. moderately meteoric without palpable resistences. Per rectum: 0. Blood: Hb. 70 p.c. Red cells, 3.7 m., white cells, 3,200. Prothrombin index 108. Meulengracht's method 3. Citric acid phosphate value normal. Alb. pos. in urine. Sed. showed a few red and white cells as well as hyaline columns.

Rtgn.-examination: Plane radiograph showed moderately distended small intestines.

Fig. 3. (Case 2.) See the text.

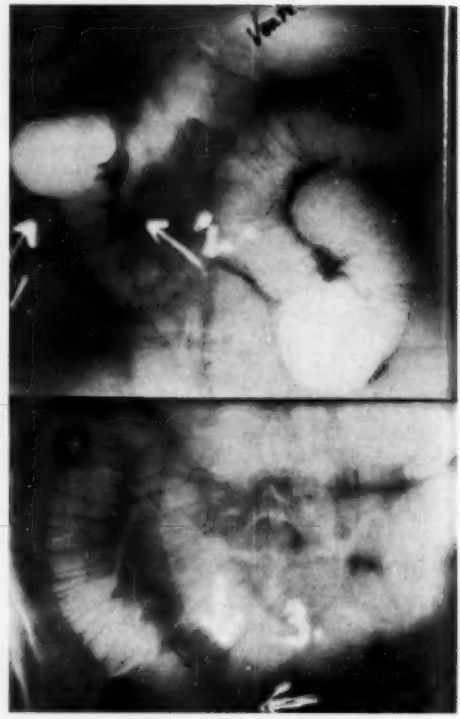

Fig. 4. (Case 3.) See the text.

Contrast meal (Fig. 4). Showed at the proximal portion of the duodenum an accumulation of contrast medium which was believed to have escaped from the gall bladder, suggesting the presence of a fistula. The contrast medium then extended distally from the gall bladder (1.) into the common bile duct (2.), After 24 hours the intestines were still distended, and in their most distal portion was a filling defect (3.). Diagnosis: Ileus (gall stone).

Operation: 12th Oct. Laparotomy — Removal. Short incision around umbilicus. Abd. contained no notably increased amount of free fluid. Some of the small intestines were distended, others collapsed. Roughly in the middle of the ileum a stone almost the size of a hen's egg, was palpated inside the intestine. About 15 cm. orally thereto was a smaller stone. Incision over the large stone, which was removed, as was also the other. Careful palpation showed that the choledochus region was surrounded by a mass of sclerotic, connective tissues. Rtgn. exam. on 30th Oct., revealed a fistula between the oral part of the duodenum and the gall bladder, as well as a radiopaque filling of the cystic duct and the choledochus. Discharged as healed on 30th Oct.

Case 4. J. 4180/44. Surg. II S.S., J.O.O.

A 73-yr.-old woman, hospitalized 10th Nov. until 17th Nov. 1944 for: Ileus obturationis (gall stone). Nursed for gall stone in 1942. Fell ill on 9th Sept. 1944 with abd. pains and vomiting. Abd. gradually swole and stabbing pains increased. Gas and fecal retention.

From Status: No malaise, no icterus. Perpetual arrhytmia. B.P. 220/140. Lungs: 0. Abdomen was swollen, distended, tender, no palpable resistance. Abundant escape of gas after intestinal washing, abdomen became softer, collapsed and was less tender. Urine: 0 alb. Sediment: A few red and white blood cells as well as columns. No bact. Blood: Hb 101 p.c., red cells 5.2 m., white cells 10,000.

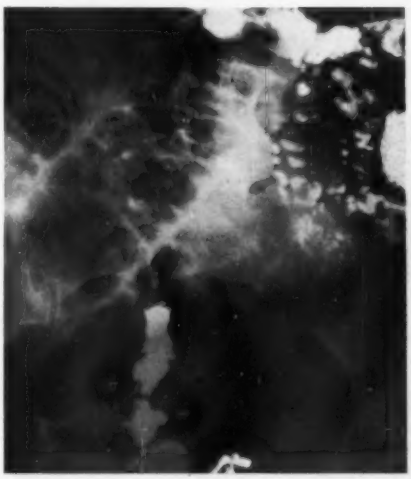

Fig. 5. (Case 4.) See the text.

The Rtgn.-examination: Plane radiograms showed moderately distended loops of the small intestines, especially in the oral part of the abdomen, with fluid levels. The colon showed no pathological changes. Diagnosis: Ileus of the small intestines.

After a further 24 hours the dilatation of the small intestine had increased somewhat. To the right in the small pelvis there was observed a vague annular shadow that might be indicative of a stone (Fig. 5, arrows).

Operation: 11th Nov. Laparotomy — Enterotomy — Removal of stone. Median incision. Small intestines strongly distended. In the most caudal part of the small pelvis, almost one meter of the ileum was collapsed. Orally thereto was a hard, stone-like formation completely occluding the intestinal lumen, and incapable of being squeezed further. Longitudinal incision, a walnut-sized stone was removed and the intestine was sutured in transverse direction in three stages.

Ileus condition continued post-operatively. On 13th Nov. Laparotomy was again performed and an ileustomia was performed. Abundance of gas and fluid escaped. After a further two days the temp. rose and signs of pulmonary affection were manifest. Exitus occurred 17th Nov. owing to cardiac insufficiency with signs of pneumonia.

Post mortem exam. Heart enlarged with pronounced left hypertrophy. Flesh was pale, rather hard when cut, and dehydrated. Both lungs showed signs of broncho-pneumonia. Abd. contained no foreign fluid and the serosa was smooth. The fistula was found in the middle of the jejunum, and a sutured op. wound in the oral part of the ileum. Stomach: 0. The duodenum was strongly adherent to the gall-bladder region and between the intestine and the severely cirrhotic gall bladder there extended a finger-wide fistula. No stone was found in the choledochus or gall bladder.

Case 5. 648/47. Surg. I.S.S., A.E.P.

A 61-yr.-old woman, hospitalized 23rd Feb. until 5th March 1947 for: Ileus obturationis c. lithiasis vesicae felleae — Schizophrenia. Appendectomized 1946. Began to vomit somewhat on 20th Feb. 1947. Abd. was tender. Temp. afebrile, but pulse rapid. Vomiting

Fig. 6. (Case 5.) See the text.

Fig. 7. (Case 5.) In the lowest part of the distended and fluid-filled small intestines there is a curvature of the type met with in gall stone obturation (3).

continued; expelled contents first bile-coloured, then ill-smelling and on admittance, purely feculent. From status: nauseate, pale, dehydrated. Schizophrenic dementia with negativism. Temp. 37.0. Pulse 90/min. Heart and lungs: normal. B.P. 140/180. Abd. very slightly meteoric without localized tenderness, muscular defense, or resistance. Per rectum: 0.

Rtgn.-exam. on 23rd Feb. disclosed a colon filled with scybala. No clear signs of intestinal ileus nor changes attributable to calculus.

After this exam. pat. felt better for a time but already the following day she again began to vomit violently, for which reason the rtgn.-exam. had to be completed.

Contrast meal (Fig. 6 & 7) showed a large dilatation of stomach with delayed discharge. At the juncture between the bulb and pars descendens duodeni there was an accumulation of radiopaque medium which was in open connection with the duodenum via a 1-cm wide fistula. The accumulation was at the site of the gall bladder (1.), from which the cystic

duct was filled with radiopaque medium whilst the choledochus was not clearly manifest. There were possibly a number of small stones in the cystic duct (2.). The small intestines were full of fluid and distended. In the most aboral part of the distended small intestines there was a curvature of the type generally met with in gall stone obturation (3.).

Diagnosis: Gall-stone ileus.

Operation: 24th Feb. Laparotomy — Enterotomy. Median incision at umbilicus. Practically the whole of the jejunum was distended and had red-coloured loops. The ileus condition was due to a walnut-sized gall stone obturating the lumen. It could not be squeezed down. Longitudinal incision, removal of stone and suture in transverse direction. The ileus condition subsided immediately. At the site of the gall bladder a solid infiltration was observed but no stones. Region left untouched. Discharged as healed on 5th March, 1947.

Discussion

It seems as if gall-stone ileus may manifest itself in different manners. Three different forms of the lesion seemed to be distinguishable, namely, an acute form with more or less violent symptoms, a remittent form with repeated biliary colic, and a latent form with a more or less pronouncedly chronic course. If we try to classify our own cases, we see that they all fall within the first mentioned group, although a certain remission is detectable in one case (V). We observed no symptoms referable to that moment when the impacted stone left the gall bladder on its passage to the intestine. A history of cholelithiasis existed in four cases (I, II, III, IV) whilst cholecystography performed a long time previously to last onset argued for gall stones in three cases (II, III, IV).

At the clinical examination ileus obturationis was suspected and diagnosed as probable in all cases. The most useful source of help at our disposal in diff. diagnostically distinguishing various ileus causes from other abd. lesions was the roentgen examination.

In two of the cases (II, IV) the plane radiogram revealed a clear picture of ileus of the small-intestinal type with distended, gassy small-intestinal loops. Moreover, shadows of radiopaque calculi reminiscent of gall stone were discerned aborally to the distended small intestines.

In the remaining three cases (I, II, V) no ileus symptoms were distinguishable in the plane radiograms, in spite of the fact that 2 to 3 days had elapsed between the onset of the lesion and the roentgen examination. Neither could any radiopaque calculus be observed.

In the last three cases the roentgen examination was followed-up by a contrast meal which divulged: 1. Ileus symptom of small-intestinal type with small intestines full of fluid. 2. Signs of an internal fistula, and 3. obstruction of the passage with a filling defect in the terminal portion of the radiopaque tract, suggestive of stone obstruction.

In spite of the fact that an internal gall fistula had been established in all of these cases mentioned none of them revealed gas in the gall ducts.

The roentgenological symptom-triad suggestive of gall-stone ileus consists of 1) Ileus, 2) Fistula, and 3) Stone. If, in the roentgen examination of an abdominal case, a combination of an ileus of the small intestine and a radiopaque calculus in the caudal part of the obstructed intestine can be shown direct in plane radiograms the diagnosis »gall-stone ileus» is absolutely clear.

If, on the other hand, the combination ileus + fistula-symptoms based on the presence of gas in the gall ducts, is found, such a combination constitutes a strong support for the diagnosis »gall-stone ileus», but the diagnosis is only probable. We pointed out further up in this paper that gas in the gall ducts may appear in the absence of an internal gall fistula.

Our material included cases (I, III, IV) in which the plane radiograms showed no signs of ileus, stone or fistula. In such cases a contrast meal is very valuable. One may without exaggeration say that this examination method is the only one that renders a diagnosis possible. For the surgeon, the verification of a suspected ileus is important even although its nature cannot always be predicted.

From the above description of the roentgen examination results, it will be apparent that contrast meals are superior to other methods in the cases in question. In all the cases examined the requirements of the roentgenological symptom-triad warranting the diagnosis g-ileus, were fulfilled.

Our cases were admitted to the surgical dept. for operation 2 to 6 days after the onset of the lesion. In one case (IV) exitus occurred, but this was probably less due to the operation than to pre-existing myocarditis with myocardial insufficiency and secondary broncho-pneumonia.

As to the surgical therapy, there is not much to be added. All the stones were removed by ordinary enterotomy which is presumably the normal method after attempts had been made (Cases: II, IV, V) to squeeze the stones down to the colon. One case (III) was interesting inasmuch as two relatively large stones could be removed at one and the same enterotomy. In none of the described 5 cases were attempts made to inspect the gall bladder region for other calculi. This precautionary measure ought to be taken into consideration in these cases actually suffering at the time of the examination. A radical operation, possibly with the removal of the gall bladder ought preferably to be postponed.

SUMMARY

A general survey of the symptomatology of the gall stone ileus and of the development of its roentgenological diagnosis together with a description of five own cases with pre-operative diagnosis. A discussion follows with classification of the cases and analysis

of their diagnosis. By the roentgen examination the contrast meal method seems to be the most valuable. The preferable operative method is enterotomy with removing of the stone.

ZUSAMMENFASSUNG

Eine allgemeine Übersicht über die Symptomatologie des Gallensteinileus unter Berücksichtigung der Entwicklung der Röntgendiagnostik und Beschreibung von fünf eigenen Fällen mit präoperativer Diagnose. Es folgt eine Diskussion mit Klassifikation der Fälle und Analyse der Diagnosen. Röntgenologische Unteruschung mit Kontrast scheint das beste Resultat zu geben. Die operative Methode der Wahl ist Enterotomie mit Wegnahme des Steines.

RÉSUMÉ

Un sommaire de la symptomatologie de l'iléus provoqué par des calculs biliaires et du développement du radiodiagnostic. Les auteurs donnent aussi une description de cinq propre cas, diagnostiqués pré-opératoirement. Une discussion suit avec classification des cas et analyse du diagnostic. Pour l'examen radiologique la méthode avec repas radiopaque semble donner le meilleur résultat. La méthode chirurgicale à préferer est l'entérotomie avec l'extraction du calcul.

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FROM THE ST. CANISIUS-ZIEKENHUIS, NIJMEGEN, THE NETHERLANDS.

MYELOGRAPHY BY RESORBABLE CONTRAST SUBSTANCES[1]

by

J. Th. van der Werff, M. D., Sc. D.

LINDBLOM's report about his experiences with the myelography by abrodil, previously introduced by ARNELL and LIDSTRÖM, and ARNELL, impressed us very much, not only by the fact that by the use of a quickly resorbable contrast-substance the danger of a future lipiodol-arachnoiditis is avoided, but also by the clearness of the pictures. Consequently we decided to introduce this method in our laboratory. However, one thing in LINDBLOM's technique attracted our attention, viz. the making of 4 exposures with horizontal roentgen-ray beam and a 5th one with a vertical beam. This means a somewhat awkward complication, for if one does not dispose of a suitable installation with two roentgen-tubes, one is compelled seriously to manipulate the patient, who is already in an unpleasant situation caused by the lumbar-anaesthesia. Now BARTELINK previously pointed out, in the days when only lipiodol was used, that one obtains a much better insight into the relations in the lower part of the dural sac, if one makes an exposure with a horizontal roentgen-ray beam and the patient prone. In order to make such an exposure we used a narrow tilting table (fig. 1) which was placed before the roentgen screen. The slope of this tilting table could easily be varied. So the ordinary examination with lipiodol myelography was completed by the exposure with the horizontal roentgen-ray beam.

The technique of abrodil-myelography requiring already 4 exposures with the horizontal roentgen-ray beam, the existing narrow tilting table being of good use, it will be obvious that we replaced LINDBLOM's 5th exposure by our exposure with the horizontal roentgen-ray beam and the patient prone. Reducing the number of exposures by one, we further made the different exposures according to fig. 2. Of course, this means an important simplification of the technique.

[1] Submitted for publication, Nov. 4, 1948.

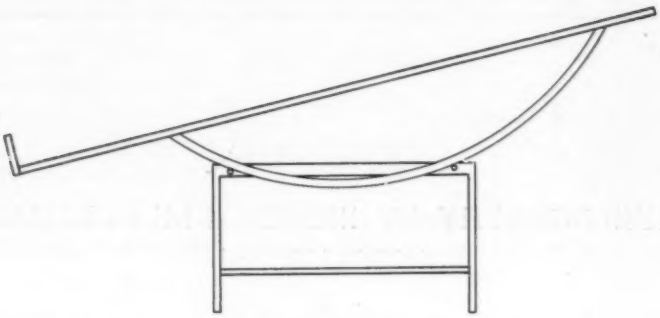

Fig. 1. Tilting table used for myelography with horizontal roentgen-ray beam.

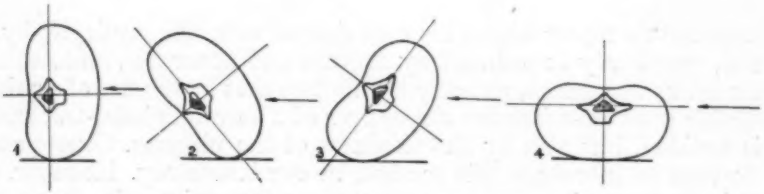

Fig. 2. Scheme of the various exposures used.

But it appeared, moreover, that this last exposure is most important. Though the presence of a disc protrusion is often visible on this 4th exposure as well as on one of the other ones, there occur a relatively large number of cases in which the disc prolapse is only visible on this 4th picture. Of course, there are also some few cases in which the disc protrusion is only found on one or two of the first three ones. This only happens if the prolapse is all at the side.

By this 4th exposure one gets a complete insight into the width of the epidural space. In normal cases (fig. 3) one sees the contrast column lying down flatly upon the backsides of the bodies of the vertebrae. At the intervertebral discs there are small physiological thresholds. If a disc protrusion is present one sees the epidural space widening *abruptly* and the contrast column is often lifted up in an arc (fig. 4 and 5). However, it must be noticed that in a certain percentage of the cases ($\pm$ 15 %) the epidural space widens *gradually* over the lower lumbar and the first sacral vertebrae (fig. 6). If there is no sign of an extra dent in the contrast column, we do not accept the presence of a disc-protrusion. So, for the diagnosis of a disc prolapse, we require the presence of a clear discontinuity. In fig. 7 is shown a case in which

Fig. 3. Normal width of the epidural space.

Fig. 4. Sudden widening of the epidural space: prolapse at L4—L5.

Fig. 5. Multiple prolapses at L3—L4 and at L4—L5.

the 4th exposure does not reveal a disc prolapse, while it is distinctly shown by the other ones.

For the rest we followed rather precisely the technique indicated by LINDBLOM: The patient is placed upon the tilting table, lying on the sick side, his back turned to the screen. After having removed the screen temporarily, a low lumbar puncture is made, 10 cc liquor is removed and 1.2 cc 10 % novocaine is injected. Thereafter 1 cc ephedrine (50 mg)

Fig. 6. Gradual widening of the epidural space: no prolapse.

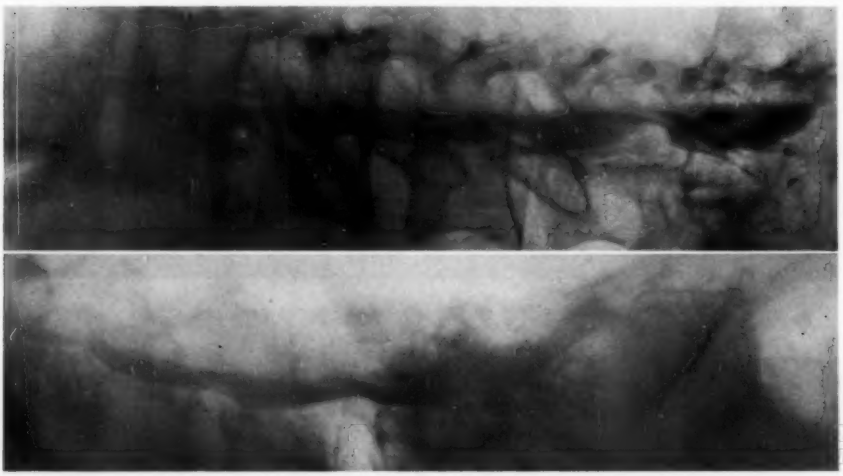

Fig. 7 a.

Fig. 7 b.

Fig. 7 a. Big prolapse at L4—L5. (Exp. 1.)

Fig. 7 b. The same case. (Exp. 4.) Although there are big thresholds the prolapse is not clearly seen at this exposure.

is given subcutaneously and the blood pressure is continuously controlled.

After 15 minutes, as a rule, the anaesthesia is sufficiently developed and then 10 cc of the contrast substance is injected. We used 20 % abrodil, 25 % dijodon, and also 37.5 % uropac and 37.5 % uroselectan B, with which very good contrasts were obtained. Immediately after the injection the screen is replaced and under fluoroscopic observation the tilting table is lifted to such a slope that the contrast column covers the whole lumbar region. Then the exposures 1, 2, 3 and 4 are made. Without waiting for the results of the exposures the screen is removed,

another lumbar puncture is made and 20 cc liquor, mixed with contrast substance is made to flow away. By moving the tilting table a little up and down during this flowing-away practically all contrast substance is very rapidly removed so that there remains only little for resorption. The patient is then put to bed with instructions not to lie on his back or on the healthy side during the next 24 hours. By this technique there are no specially annoying complications. With the first cases we examined, when the 20 % abrodil etc. was not removed at all, there occurred more cases with serious pains and spasms than we had expected according to LINDBLOM's report. That is why we advise the removal of the contrast substance in every case immediately after the exposures.

Fig. 7 a.

As for the results, these were indeed very good. Up to now we have examined 60 cases. In 29 of these a disc-protrusion was found by the myelography and the finding was confirmed by the operation, during which the prolapse was also found at the predicted place. In 5 other cases there was also found a disc prolapse, but the patient was not operated on for special reasons. In 2 cases multiple prolapses were roentgenologically clearly found at L3—L4, L4—L5, and L5—S1, but with the operation only the latter was found. These 2 discrepancies may be a consequence of the fact, that with a real hernia of the nucleus pulposus, part of the nucleus may slip now and then through a defect in the annulus fibrosus. These patients have intermittent pains. So sometimes the prolapse will be found, while it may be absent at other times.

In the remaining 24 cases, where no prolapse was found roentgenologically, the patients were treated conservatively and there was afterwards no reason to submit these patients to operation.

Fig. 7 b.

SUMMARY

The author communicates his experiences with 60 myelographies by abrodil, dijodon, uropac and uroselectan. LINDBLOM's technique was simplified by replacing the exposure with vertical roentgen beam by another one with a horizontal beam and the patient prone. The author thinks that this last exposure also means a further improvement for the interpretation, as it gives a very good insight into the epidural space which is almost always influenced by the occurrence of a disc protrusion.

ZUSAMMENFASSUNG

Verfasser berichtet über seine Erfahrungen mit 60 Myelographien mit Abrodil, Dijodon, Uropac und Uroselectan. LINDBLOM's Technik wurde vereinfacht durch die Ersetzung der Aufnahme mit vertikaler Strahlenrichtung von einer mit horizontaler und dem Patienten in Bauchlage. Der Verf. ist der Meinung, dass diese letzte Aufnahme auch für die Interpretation eine Verbesserung bedeutet, da sie ein sehr gutes Bild des epiduralen Raumes gibt, der fast immer von einem anwesenden Discusprolaps beeinflusst wird.

RÉSUMÉ

L'auteur donne un exposé de ses expériences avec 60 myélographies à l'abrodil, au dijodon, à l'uropac et à l'uroselectan. La technique de LINDBLOM était simplifiée par le remplacement de la radiographie à faisceau de rayons dirigé verticalement par une autre à faisceau horizontal et le malade en décubitus ventrale. L'auteur est d'opinion que cette dernière exposition permet une interprétation plus sûre étant donné qu'elle donne un meilleur image de l'espace épidurale, laquelle est presque toujours influencée par la présence d'une prolapse de la disque intervertébrale.

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SUR LA RADIOGRAPHIE D'UN ORGANE MIS À NU PAR OPÉRATION[1]

par

Jacob Nordentoft

A propos d'une communication donnée par OLLE OLSSON au sujet d'un châssis pour la radiographie d'un rein mis à nu par opération, je dirai d'abord que sans doute celui-ci constitue un progrès considérable et qu'il trouvera sûrement une application générale.

Je tiens pourtant à signaler que depuis quelques années je me tire d'affaire en stérilisant par le formol les films dans une étuve à formol à vide (à 32°). Les films ont très bien supporté ce traitement. On utilise la dimension qui convient au but. J'ai voulu mentionner le fait que les films peuvent être stérilisés par le formol, car je ne suis pas sûr que ce soit un procédé généralement connu. Pour éviter de mouiller le film je l'ai placé, ces derniers temps, dans un petit châssis arqué en aluminium, produit par A/S »Dansk Røntgen Teknik».

L'image ci-jointe (Fig. 1) a été prise sur un film stérilisé de cette manière. Le film peut très bien être conservé pendant quelque temps après la stérilisation.

Fig. 1.

[1] Remis à la rédaction le 13 Nov. 1948.

RÉSUMÉ

L'auteur attire l'attention sur le fait que les films pour la photographie d'un organe mis à nu par opération peuvent sans dommage être stérilisés par le formol.

SUMMARY

The author points out that any film used for photographing an organ which has been exposed by operation, can be sterilised with formol without causing damage to the film.

ZUSAMMENFASSUNG

Verfasser macht darauf aufmerksam, dass Filme, welche zum Photographieren eines durch Operation frei gelegten Organes verwendet werden, ohne Schaden zu nehmen mit Formol sterilisiert werden können.

FROM THE ROENTGEN DIAGNOSTIC DEPARTMENT OF THE UNIVERSITY CLINIC IN LUND, SWEDEN (HEAD: PROF. H. HELLMER)

STUDIES ON BACK-FLOW IN EXCRETION UROGRAPHY

Suppl. LXX, Acta Radiologica, 80 pages, 42 illustrations

Autoreview by

Olle Olsson

The term »pyelovenous back-flow» is based on observations made on cadaver specimens and on kidneys of experimental animals, *i. e.* in one case on non-vital material and in the other, on material in which the topographical relationship of the renal veins and the calices is different from that in man. On the basis of these investigations far-reaching conclusions have been drawn concerning the clinical significance of these back-flows.

The manifestation of back-flow in retrograde pyelography was described in the literature with the use of those terms pre-coined in connection with the above-mentioned experiments, and thereby gave the term »back-flow» and its clinical significance a bewildering interpretation.

The knowledge of *back-flow in association with excretion urography* is very scanty.

As back-flow in excretion urography plays an important rôle both diagnostically and differential-diagnostically, the author studied the phenomenon on a relatively extensive material consisting of 100 intravenous urographical examinations exhibiting back-flow. In 94 examinations back-flow did not occur until after the application of ureteral compression, whilst in 6 cases back-flow occurred in association with an acute attack of renal colic.

On the basis of this material the *roentgen anatomy* and *frequency* of back-flow in excretion urography, the *time necessary for the radiographic visualization* as well as the *course* of back-flow, are discussed.

In experimental back-flows the sinus extravasates constitute but a very transient stage on the way to completed pyelovenous back-flow. In excretion urography such sinus back-flows form the most common type, but this initial sinus back-flow spreads essentially in the sinus and may at times pass through the hilus out into the perirenal space. This course, which contradicts earlier conceptions, is, as shown by the

author in an experimental situation, created especially for the purpose, constant in man under vital conditions.

Pyelovenous back-flow, however, also appears in urography, and this type of back-flow as well as pyelolymphatic back-flow in excretion urography are demonstrated. Pyelolymphatic back-flow is more frequently demonstrable than pyelovenous back-flow with a contrast filling of the veins. The former type of back-flow, in spite of its not having been demonstrated previously in excretion urography, is not altogether rare.

On the basis of the above-mentioned examinations the author discusses the *significance* of back-flows in excretion urography, which seem to be of a different character than hitherto presumed.

The *diagnostic importance* of back-flow is discussed in a chapter on back-flow in tumor renis, and the *differential diagnosis* of renal tuberculosis and traumatic renal rupture is elucidated.

The last chapter deals with a hitherto unknown type of *back-flow* observable *in acute excretion urography in association with renal colic.* These back-flows, probably not uncommon in acute urinary stasis, are of great clinical, patho-physiological, and roentgen diagnostical interest. As these back-flows are not urographical artefacts but integral parts of a clinical picture, they also considerably enhance the general interest in back-flows.

SUMMARY

The author gives a short abstract of his studies on back-flow in excretion urography published as Supplementum LXX to Acta Radiologica.

ZUSAMMENFASSUNG

Verf. gibt eine kurze Zusammenfassung von seiner Arbeit »Studies on Back-Flow in Excretion Urography» (Studien über das Refluxphänomen bei der Urographie), Acta Radiologica, Supplementum LXX.

RÉSUMÉ

L'auteur donne une analyse abrégée de son ouvrage »Studies on Back-Flow in Excretion Urography» (Études sur le reflux dans l'urographie intraveineuse), publié comme Supplementum LXX aux Acta Radiologica.